Ref 7/F

Unasylva

Volume VII, Number 1 • March 1953

An International Review of Forestry and Forest Products

COMMONWEALTH MYCOLOGICAL INSTITUTE
7 APR 1953

FORESTS AND ECONOMIC PROGRESS IN ASIA

By the time that the second session of FAO's Asia-Pacific Forestry Commission opened at Singapore in December 1952, a shipment of about 60 tons of various Burmese non-commercial hardwoods, which FAO had arranged to have tested and processed in Europe by the latest methods, was on its way back to Burma. This is one of the practical ways in which FAO hopes to assist the countries of the East in the solution of their tremendous housing problems.

Southeast Asia, where there are more than 600 million people, has a housing shortage greater than any other part of the world. The climatic conditions of this region, with distinct seasonal changes between heavy rains and strong sunshine, require particularly effective shelters for the physical and mental well-being of the people.

The magnitude of the problem, lack of experience, and difficult political and economic conditions do not yet allow a generally applicable solution. Many of the countries of the region, however, are now endeavoring to found their future on a new economic and social basis. The solution of the housing problem, especially in the overcrowded urban and rural districts, is one of the chief prerequisites for social development as well as for stable political conditions.

Better and cheaper building materials need to be produced in large quantities from domestic sources. Durable timbers are becoming more and more expensive and scarce in the whole region, whereas non-commercial and mostly non-durable hardwoods are widely available. To convert these species into reasonably priced, high-class building material for walling, flooring, roofing, doors, windows, industrial constructions and even for utility forniture is a basic problem of forest utilization and forest management. It requires progressive methods of seasoning, impregnation or mechano-chemical conversion.

The experimental processing of Burmese timbers in Europe arranged by FAO has already proved in its first phase that potential wealth lies in the disregarded "non-commercial" hardwoods of the tropics if far-sighted national development schemes can ensure a long-term demand for the products. Progress along the same lines might be achieved by introducing bamboo for the reinforcement of concrete and replacement of steel.

Fuel is another commodity with which the forest must make a tremendous contribution to the economy of the region. Available statistical figures reveal only small percentage of the actual consumption, which is met to a very great extent from unrecorded sources. Recent FAO investigations have shown that the actual consumption of firewood and charcoal exceeds the statistical figures by 7 to 20 times, and that in quantity fuel is by far the greatest item of wood utilization in the region. Wood will for long be the chief household fuel in this part of the world because it can be obtained from local sources.

But the uneven distribution of forest resources, the growth of population and the drain on exhaustible sources calls for a long-term production program to meet the growing requirements. Afforestation with fast-growing species near to consumption centers, and increased efficiency in consumption by the development and introduction of improved cooking devices are two answers to this problem.

There has been a joint ECAFE - FAO investigation into the use of fuelwood for locomotives in Southeast Asia. A similar study is required on the more efficient use of wood in industries both for heat and power. A broad regional survey of all aspects of the fuelwood problem is contemplated, covering production and consumption. Regional training and demonstration centers may be arranged to encourage the more efficient utilization of domestic fuels in households, industry and transportation.

Supply of indispensable building material for transportation is the third essential contribution of forests to the economies of Eastern countries. A campaign has been started for reducing the unduly high quality requirements for railway sleepers, for broader application of chemical treatment and for introduction of treated non-durable species instead of durables.

Regional standardization of dimensions and of other specifications will be an ultimate goal. Much research has still to be done before the experiences of the

(Continued on inside back cover)

Unasylva

An International Review of Forestry and Forest Products

Vol. VII, No. 1 **March 1953**

CONTENTS

A Contribution to Tropical Forest Utilization 2
by K. A. Miedler, FAO Technical Assistance Officer, Burma.

Eucalyptus Study Tour 10
by FAO Staff

The Charcoal Problem in Asia 13
by E.E.F. Uhart, FAO Technical Assistance Officer, Iran

India's Declaration on Forest Policy 16
by FAO Staff

International Union of Forest Research Organizations 18

Silviculture of Lowland Dipterocarp Forest in Malaya 19
by A. B. Walton, R. C. Barnard, and J. Wyatt-Smith, Malayan Forest Service

Timber Constructions at the Olympic Games .. 24
by H. Rahtu, Director of Laboratory, State Institute for Technical Research, Helsinki, Finland

Commodity Reports
Fuelwood 26
Railway Sleepers 30

Work of FAO
Sixth International Grassland Congress 33
European Commission on Forestry 34
Pulp and Paper Consultation 35
Asia-Pacific Forestry Commission 37

Equipment News 40

News of the World 43

Reviews 48

Cover Photograph: *An FAO Mechanical Logging Training Centre has been operating in the Philippines since 1 October 1952 under the direction of H. G. Keith. Forty trainees from 11 countries of South-east Asia have been attending the course. The cover photograph shows logs being put into rafts for floating down from the forest to the sawmill in an area operated by the Nasipit Lumber Company, where trainees spent a month observing actual logging operations.*

SUSTAINED YIELD AND THE NATIONAL CONSCIENCE

Forestry is far more than the growing of trees. It is a manifestation of the only code of ethics by which the world can advance. Forestry utilizes the natural resources of this world and the same time preserves and improves them for future generations.

We foresters speak of sustained yield and of crops which mature in over a hundred years as accepted basic facts. Research, management and utilization progress; yet, unless and until we induce all our fellow citizens to accept the necessity for the sustained yield development of all natural resources as an integral part of their way of life, we have failed, and are not foresters but tree farmers.

No forester worthy of the name plans only the harvesting of the present crop and neglects to take preventative measures to save the next crop from the dangers of fire, insects and fungus. Present carelessness resulting in future loss is repugnant to us. We take the long view. But of recent years, though scientific research may have shed more light on the long path ahead, it has acted like a searchlight beam and hidden from our eyes dangers that lie in the unlit areas outside the narrow beam. Had the beam been broader, had our view been broader, we would have seen a very real danger that threatens forestry. We are not only technically competent tree growers, we are also administrative servants of the public, expected to take all necessary measures to guard the public forest domain against all dangers, including the ignorance or apathy of the electorate.

Forestry is bred and nurtured on a hope and belief in the future, and in the continuation of wise government. If people believe in planning for the future and all that it implies, then their feet are set in the way towards further advances in civilization. If people believe in selfish exploitation, knowing that if they do not fell trees and loot the earth someone else will, then they will leave deserts as their epitaph.

People do not understand the necessity, the why and the wherefore of forestry or of other sustained yield development of natural resources. They do not know that the problem exists, and will not unless and until we teach them.

Figure 1 – *Handling and storage of Burmese non-durable hardwoods before processing at an industrial plant in Europe: the picture shows crane-haulage of a log of "Leza"* (Lagerstroemia tomentosa).

Figure 2 – *Walling units for one complete tropical house ready for shipment to Burma (plinth area covered is estimated to be approximately 800 sq. ft.).*

A Contribution to Tropical Forest Utilization

Experience with Burmese Timbers for Housing

by K. A. MIEDLER,
FAO Technical Assistance Officer, Burma

TWO years ago, an FAO mission visited Burma to investigate the possibilities of developing an integrated forest industry so that the country could meet its domestic timber requirements and increase its exports. The present timber yield in Burma is limited owing to a variety of circumstances, and the economic benefit which the country is at present obtaining from its forests is by no means in proportion to its potential natural timber resources.

Apart from the general inaccessibility of the forests, lack of transport and difficult climatic conditions, it is above all the composition of the tropical forest itself which makes complete utilization of the resources under intensive forest practice impossible. The large variety of species with widely varying technical properties, even in relatively small forest areas, prohibits complete utilization, and, under present circumstances, only a comparatively small selection of the most valuable species is extracted.

In Burma, up to the present, timber exports have been mainly confined to teak and the management of this species has given its particular characteristic to Burmese forestry. Teak also plays an important part in meeting domestic timber requirements on account of its excellent working properties, strength and durability. Although about 40 timbers other than teak have a certain domestic market value, and a further 200 to 300 species are counted, by reason of their frequency, type of growth and technical properties, as usable timbers, these hardwoods, which constitute a far larger proportion of the forest stands than teak, have only a minor and local importance.

Teak production in Burma before the war reached a yield of 450,000 tons (1 ton = 50 cubic feet) of roundwood per year, which is probably about the maximum possible under sustained yield management. Therefore, if timber production is to be stepped up, this can only be done by greater exploitation of the neglected hardwoods other than teak. Owing to the excessive cutting of teak during the war, a decrease of some 10 percent in output below the prewar figure can be expected to be set as a target, but the production of non-teak hardwoods, which today equals in quantity the production of teak, could be increased fourfold.

This potential increase is conditional on removing the technical drawbacks due to certain characteristics which up to now have hindered widespread utilization of these species. These characteristics are essentially the following:

1. poor durability,
2. insufficient retention of shape,
3. the difficulties which the timbers present for air and kiln-drying under local conditions.

The fact that the vast majority of tropical timbers are highly susceptible to attack by fungi and insects, above all termites, is well known and nothing further need be said here. On account of this, all construction work in the tropics — other than work carried out with naturally durable timbers which are scarce — is destroyed by fungi or insects in a relatively short time; this constitutes the greatest hindrance to an extended utilization of non-durable timbers.

The tendency for high shrinkage, which is characteristic of most non-teak hardwoods, is the second great defect which is responsible for limiting their use in construction and particularly in joinery.

There is another important characteristic which is typical of many tropical woods and which has its bad effect on the retention of shape. This is a special structure of the grain, which is only found in the tropics, and which is common to about half of the

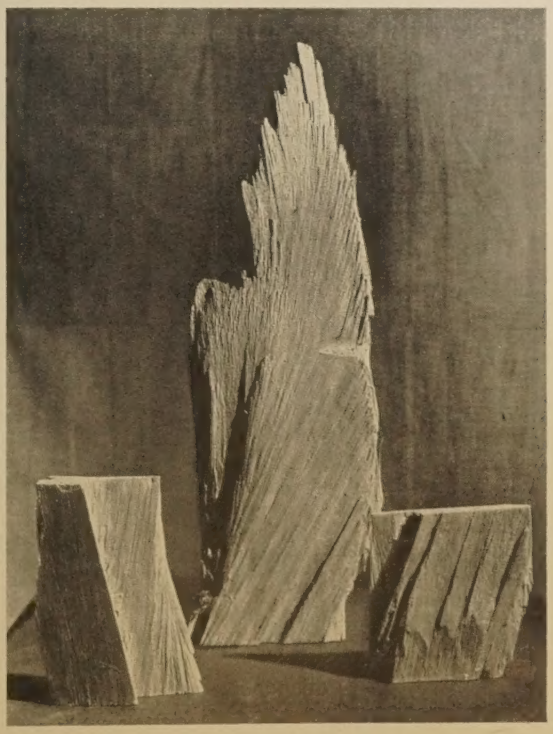


Figure 3. *Samples of "Baing"*, Tetrameles nudiflora, *Burmese hardwood typical of many tropical hardwoods; note alternating cross grains.*

Figure 4. *Samples of boards from some Burmese non-commercial hardwoods* (*Baing*, Tetrameles nudiflora; *Gwe*, Spondias mangifera; *Taungpeinne*, Artocarpus chaplasha; *Lein*, Terminalia pyrifolia) *showing tendency to warp, irregular bending and cracking after air seasoning.*

botanical species. In these species the grain does not run parallel to the axis of the trunk, but in more or less clearly defined alternating spiral layers. Figure 3 illustrates this alternating cross graining, which, while strengthening the trunk as a whole, at the same time means that converted timber will not retain its shape. This is shown clearly in Figure 4, which gives extreme examples of deformed boards which, although only air seasoned, have completely lost their original shape.

The difficulties arising both in the natural and artificial drying of tropical timber are due partly to this irregular structure and partly to the various constituents in many of the woods, such as oils, gums and resins, etc., which are a serious handicap, particularly in artificial seasoning. The high susceptibility to fungus and insect infestation of many of the non-resistant tropical woods demands both processing and drying within a very short time after felling, which in practice can very seldom be adhered to. In the majority of such cases air seasoning is impracticable because the timber, which is particularly susceptible when green, frequently deteriorates in quality before becoming dried. Air drying must be replaced therefore by artificial drying as extensively as possible.

Housing Needs

In Burma the requirements of material for house-building rank first in timber consumption.

During the war and its aftermath, the cities, towns and villages lost a large portion of their houses. There is a particular dearth of housing in the medium-sized and larger towns. The importance attached to the construction of housing is clearly evidenced by the fact that the Government of Burma has established a special Ministry of Labor and Housing, with the task of alleviating the housing shortage by a long-term program. In a country like Burma, 56 percent of whose area is forested, wood is the natural choice for building material for permanent housing. Therefore, any plans for the full utilization of the forests and the timber resources must be integrated with the housing program.

A large-scale technical experiment was arranged, as a first step, by the Burmese Government and FAO. This was in accordance with the recommendations of the FAO technical assistance mission for a four-year program which, besides a degree of mechanization of timber transport, aims at the erection of modern plants for the timber industry.

This experiment was designed to ascertain to what extent and with what success the latest developments in processing, seasoning, impregnation and improvement of timber could be applied in practice to non-teak hardwoods of Burmese origin. In order to obtain practical results as quickly as possible, it was assumed that the most recent knowledge and experience gained in connection with timbers of the temperate zone could be applied with certain modifications to tropical timbers. In this way, time consuming theoretical experiments could be spared and practical tests could be launched immediately on a large scale, supported by simultaneous scientific research in various testing laboratories.

To carry out the experiments, the Forest Department of Burma made available about 60 tons of non-teak hardwoods and 9 cubic tons of bamboo poles and mats, which were shipped to Germany, where in the plant of a leading wood-working industry near Karlsruhe, which is based on the principles of an integrated forest industry, all facilities for this large-scale experiment were offered.

This plant is equipped with large log storage installations along the border of the Rhine (Figure 1), a big sawmill, most recent seasoning and impregnation facilities and a modern chipboard factory, so that the processing of the numerous groups of timber and bamboo could be performed on the same spot.

Investigations Undertaken

The main task was to construct out of the raw material two sample houses, the plans for which were supplied from Rangoon, to be sent back to Burma when ready in order to be erected and subjected to a practical test for durability and suitability for use. The bamboo poles and mats were to be made into durable building material by appropriate impregnation.

One of the two experimental houses was to be constructed in the manner long customary in Burma, the frame of the house consisting of posts and beams, the walls made of boards with covering strips. The second experimental house was to be constructed as far as possible of building boards.

Altogether 13 different timber species were made available, including some timbers which are already in use,, such as Kanyin (*Dipterocarpus* sp.), Taung-thayet (*Swintonia floribunda*), Taung-peinne (*Artocar-*

pus chaplasha), and some which, although used for certain purposes, have not been directly used in house building, or others which are characterized by their particularly light weight or exceptionally poor durability, such as Baing, Gwe (*Spondias mangifera*), etc.

For altering artificially the constitution of the timbers and for improving their properties, three different methods of treatment were employed:

(1) Artificial drying in a high-temperature cross-draft drier built in accordance with the latest experience.

(2) Impregnation with a new synthetic resin half condensate, recently developed in Germany.

(3) The breaking up of the natural body of the timber into chips, which were then mixed with synthetic resins as binders and with other chemical materials and pressed into boards by means of a press at high temperature (130-140°C).

While the first two methods followed in principle well-known procedures and only differed through the application of the latest and quite important details, the third method introduced for the tropics something fundamentally new, the use of which on Temperate Zone species, although only developed over the last few years, has been highly perfected.

The three processes may briefly be described as follows, insofar as the effects can be ascertained from the results to date.

Drying

The new drying process is carried out in accordance with the special requirements of the different timbers at temperatures of under or over 100°C, and where necessary as high as 120°C. The innovation in this process is the high velocity of the drying air that can reach 10 m./sec. In this way, it is possible to reduce the drying time, which is the all-important cost factor, considerably below that hitherto required.

The drying chamber (Figure 5) is built of steel or aluminum sheets; all openings can be rendered absolutely air- and moisture-proof. This is particularly important because the drying process can only be kept under control if the air intake and outlet openings can be closed airtight and are also capable of being precision-regulated. The use of drying temperatures up to 120°C. is not entirely new, but has hitherto been only partially satisfactory failing the new way of horizontal air conduction now used with air directed straight into the interstices of the drying stack and kept in motion by one or more large blowers with a diameter of up to 180 cm., which are fixed to a sidewall of the drying chamber. Directly driven by an electric motor, these large fans resembling aircraft propellers are considerably more efficient than numerous small fans fixed to the ceiling, (the performance of which is considerably impaired by the multiple deflection of the drying air draft). Under the new arrangement, whereby the air stream penetrates directly from the ventilators into the stack interstices, it is possible to attain a high velocity of dry air in a very economical manner.

In such a seasoning plant, which can justifiably be called a drying machine, the main drying factors, temperature, moisture content and air velocity, can be finely regulated to any desired degree through fully automatic control apparatus. This highly-efficient drying chamber enables the optimum drying ranges for each species and size of timber to be determined, maintained and readily controlled. The drying time can be reduced to the minimum appropriate for each species, below which it is impossible to go without damaging the product.

The efficiency of this plant, that had already proved its usefulness for European species as regards cost and quality of performance, was confirmed when the Burmese timbers were dried. For example, Gwe boards with a specific gravity of 0.4 and measuring 2500 x 120 x 19 mm. were dried in the surprisingly short time of 5 hours and 50 minutes, from an average initial moisture content of 45 percent to 9 percent. A maximum temperature of 117°C. was reached without any noticeable damage. The drying of Kanyin (specific gravity 0.76) in the large dimensions of 2600 x 160 x 80 mm. required at a maximum temperature of 81°C. a drying time of 78 hours. The final moisture content ranged from 11 to 17 percent and there were only small lateral and end fissures; generally speaking, the dried product retained its shape.

Wood improvement by synthetic resin impregnation

The rapid advance in the use of the synthetic resin techniques since the end of World War II has opened up completely new possibilities for the improvement of wood properties. A wood preservation and improve-

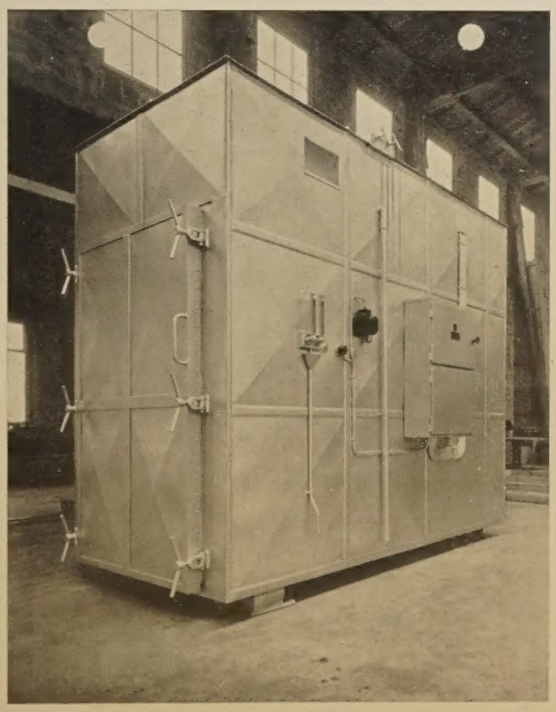


Figure 5. *Most recent quick-drying chamber working with temperatures up to 100 degrees C. and with high air velocity up to 10 m./sec.*

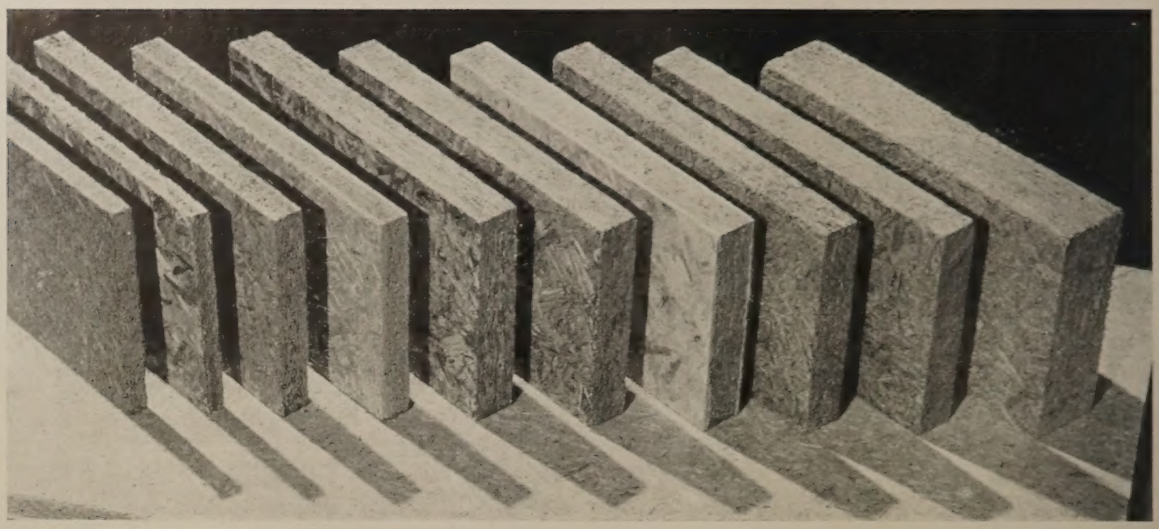
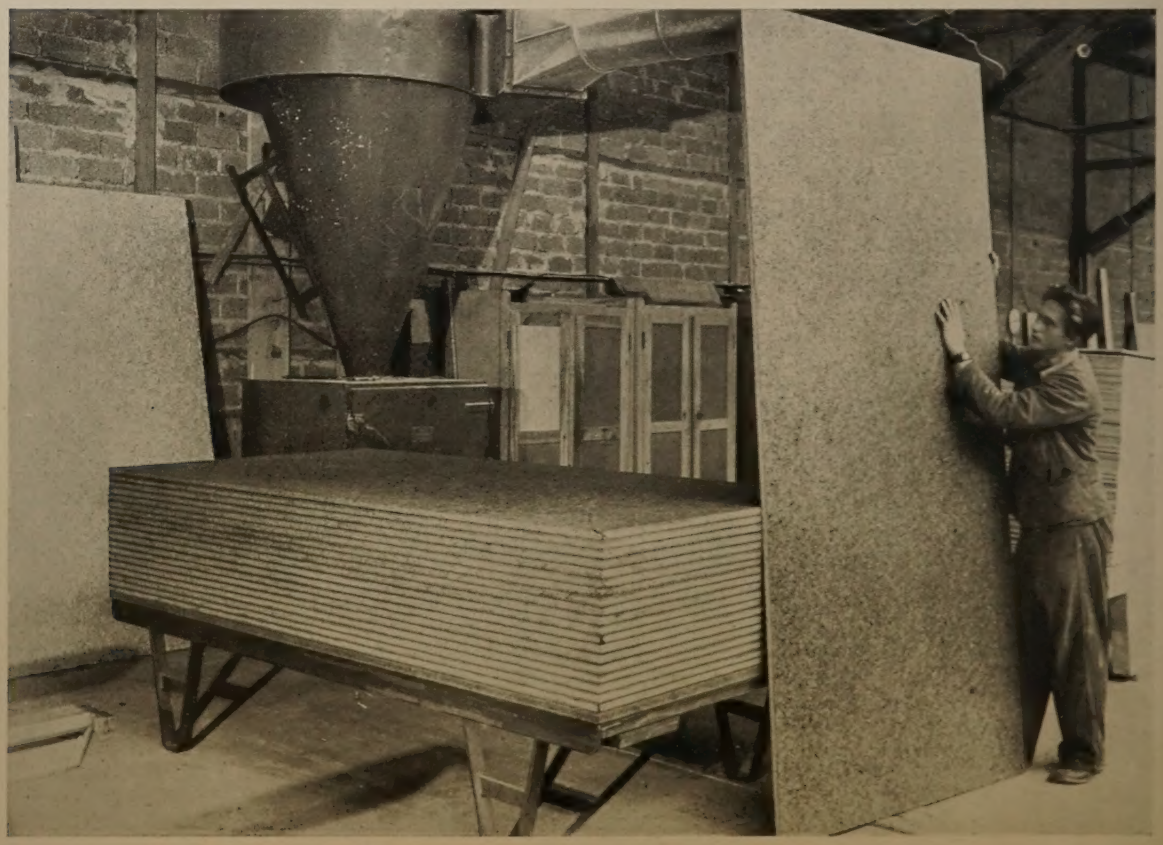


Figure 6. *Samples of different types of building boards, some made from a single species, others from a mixture of several species.*

Figure 7. *Large-scale wallboards made from Burmese hardwoods, 4 × 8 ft. after edging: photograph also shows special floor boards with outer layers of Burmese ironwood, "Pyinkado" or* Xylia dolabriformis.



ment agent has been developed in Germany and its application to Burmese timbers appears most promising.

The advantage of this impregnation process does not lie with the synthetic resin itself, but in the use of a low molecular base as an impregnation agent. A high molecular synthetic resin itself cannot, of course, penetrate the cell walls, but remains clinging to their outer surface without being able to effect any permanent change in the structure of the wood or its properties. When an initial low molecular phase is used with special resin, however, it can, because of its small molecules, penetrate the *micela* structure of the cell walls and completely fill the inter-micela spaces. A hardener, which needs a certain time to take effect, is added to the aqueous solution of the semi-condensate. The synthetic resin is thus finely dispersed when fixed in its final form, causing a substantial change in the cell wall structure and resulting in considerable improvement of various properties of the wood.

The pressure resistance of wood so treated is increased on an average by some 30 percent, the surface hardness by some 80 percent, and the degree of swelling and shrinkage lessened by approximately 45 percent compared with untreated wood. Tensile and bending strength are not affected to the same degree.

Although this special synthetic resin does not possess any toxic quality, it is an excellent wood preservative. Comprehensive tests have shown that impregnation with a 12 percent solution is generally sufficient to make timbers of European origin fungus-proof.

Tests on resistance to insect infestation have also given satisfactory results, the resistance being due to the fact that when the cell wall is partially encrusted with synthetic resin, it does not offer a feeding ground for fungi or insects. To ensure immunity, however, it is advisable to add a proved fungicide or insecticide. It has been ascertained that toxic salts can be used for impregnation without difficulty in conjunction with the synthetic resin, which has a very good fixative action on the salt solution. As a result, considerably smaller applications per space unit suffice to protect the wood completely, in comparison with the quantity of such salts which have to be introduced without an admixture of resin.

To ensure protection against termites, 1 percent of pentachlorphenol is added to the synthetic resin solution. A further advantage of impregnation with this solution is that it can take place at normal temperatures. Thus the very considerable heating costs involved in most of the processes hitherto used are eliminated.

As the tests with the synthetic resin were satisfactory, part of the construction material for the two experimental houses was treated with it, particularly the doors, window frames and casings. The chief requisite for these parts is that they should retain their shape, and it is hoped that, on the basis of the satisfactory behavior experienced in the case of European timbers treated in this way, it will be possible to use much cheaper non-teak hardwoods throughout the building and woodworking industries in Burma in place of teak.

The other, and by far the greater, part of the building timber, particularly the large-size timber, was treated with the usual impregnation salts on a fluor-sodium-chromium-arsenic basis by the full-cell process. It should thus be possible to make a reliable comparison between the effects of various wood preservatives as a guide to future practices.

Chipboards

The use of chipboards in house construction, especially for tropical houses, is a pioneer experiment whose possibilities need to be discussed in more detail.

If the Burmese Government envisages the use of timber as the principal building material for its housing program — which is logical in view of the raw material situation — its only chance of success within the prescribed time limit lies in establishing a forest and lumber industry based on modern principles, and in the mass production of houses, i. e. prefabricated houses, in selected parts of the country.

It was clear at the time that the experimental program was drawn up that the production of prefabricated houses from cheap Burmese timbers in the form of solid wood was out of the question owing to the various defects from which these timbers suffer. It would of course be possible to produce so-called "pre-cut-houses", and it would seem advisable to use this process as a transitional stage. But the drying and impregnation described above will make it possible to utilize to a far greater extent wood species which have hitherto been unusable.

A really effective speeding-up of production in housing can only be expected from mass production, whereby building parts are machine-made and only the assembling is carried out on the actual building site. Tropical timbers in the form of sawn wood are not suitable for this purpose, and as yet no other appropriate construction material has been available.

In the last three or four years, however, a new kind of wood substance known as chipboards has assumed increasing importance, and it is hoped that it may provide a solution. These boards had previously been produced only from temperate zone timbers and were used mainly in furniture manufacture, and not for building purposes.

Chipboards are produced in large units (standard size 4 x 8 feet) with adequate strength properties (lengthwise pressure resistance averages 200 kg. per cm^2), holding nails well, workable with any tools like a natural board and taking glue satisfactorily. In addition to these excellent properties, chipboards have the invaluable advantage of being practically unchangeable as regards width and length, i.e. they do not swell or shrink in either direction.

Burmese woods had first to be tested as to their suitability for conversion into chipboards. Chips were first made by various processes from all the available species, and were then used in many combinations to make boards of five different thicknesses and with different type of constructions, i.e. with one or more layers made from different species (see Figures 6 and 7). These experiments showed that species varied in their suitability for processing.

It is generally true that the lighter and softer species produced better boards as regards the compactness of the outer surface and homogeneity of the inner structure. The heavier woods, and above all those species which produce the less smooth and more brittle chips,

Figure 8. *Assembling wall units made from Burmese timber before glueing under pressure and heat.*

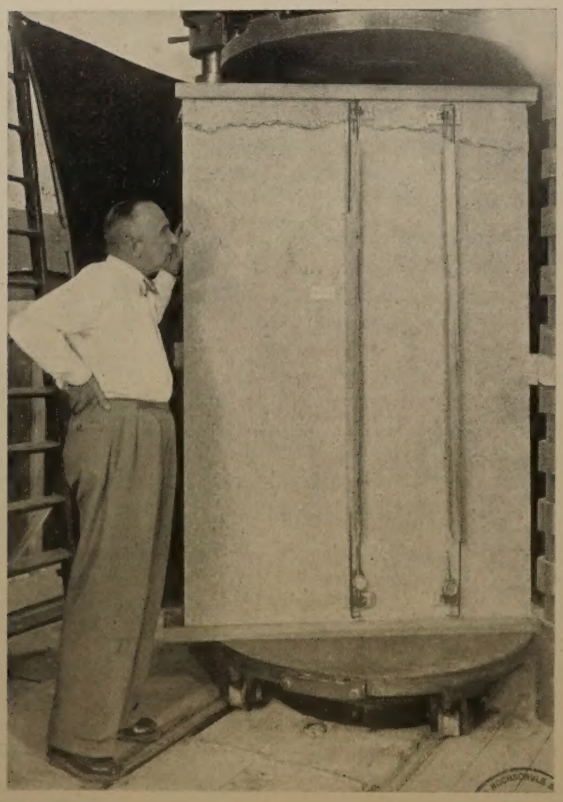


Figure 9. *Testing compression strength of walling units consisting entirely of building boards made from Burmese timbers (sample shown weighing 75 kg. supported a maximum load of 42,000 kg.).*

when converted into chipboards showed a less uniform internal structure but proved very resistant. It was therefore found preferable to use the harder and heavier chips with good natural strength for the inside, and the more pliable, softer chips for the outer layers, so that solid boards with good surface quality could be obtained.

In general it was proved that the tropical woods tested were highly suitable for the production of chipboards, and in many respects even superior to European woods, probably because of their much greater range of mechanical and chemical properties. Among other results, the surprising fact emerged that the extent of shrinkage in thickness of such boards, when made of a mixture of lighter and heavier woods, averaged only 7 percent, or less than half of the average contraction of boards made from European woods.

From one particular species, namely *Lagerstroemia tomentosa*, which has a specific gravity of 0.67, boards were produced (specific gravity 0.64) which showed the surprisingly small average shrinkage of 3.2 percent, with a minimum shrinkage as low as 2.25 percent. This phenomenon can be partly explained by the fact that certain species of Burmese wood seem to have particularly good absorption capacity for the synthetic resin which is added to the glue in the manufacture of the boards.

Construction of a Chipboard House

Since the suitability of tropical woods for chipboards had been demonstrated, the real problem that remained to be solved was the form in which they could be used for building construction. According to the original plans both the experimental houses were to have exactly the same framework, but in the chipboard house only the boards forming the wall surface were to be replaced

by chipboards nailed to the frame. For this construction it was planned to use two entirely heterogeneous materials, i. e. timber that was unreliable as regards shape retention was to be permanently strengthened with chipboards. The combination of two such widely-differing materials, however, could never in practice produce a permanent, stable structure; also by using chipboards in this way no advantage could be taken of the strength of the boards if utilized only as surface elements. Finally this design could not be used in mass production.

It was therefore necessary to return to the general principles required for pre-fabrication, with the structural parts divided into separate units and constructed in such a way that they could be entirely made of chipboards, and as cheaply as possible (Figure 8). In addition, all the units needed to be of exactly the same width and thickness in order to be interchangeable. The entire framework of the house was therefore to be of wall units capable of taking the weight of the roof. Preliminary experiments were made to determine the static properties of such a type of chipboard construction, never used before, in order to ascertain the right dimensions of the building units.

After satisfactory experiments with small models in the laboratory, wall units of normal size were made and tested for bearing and buckling strength. Figure 9 shows a unit after it had been brought to breaking point in the testing machine. The strength was found to be considerably higher than the usual resistance of nailed timber constructions, and the ratio of specific weight of a wall unit (75 kg.) to its breaking load (42,000 kg.) was unusually high.

This can be explained by the fact that the wall unit was cast in a single piece, with the perpendicular and horizontal ribs which hold the inner and outer sheets together glued throughout to the boards with synthetic resin. In this way, it was aimed to distribute the effective pressure equally over the whole cross-section of the unit and to ensure that the inner and outer boards serving as wall surfaces bore their full share of the load. The breaking line, which is clearly seen in Figure 9, also shows the normal characteristics of compression testing samples made from solid wood.

Figure 10 shows the breakdown of the wall construction into component units, all of the same width and thickness, so that they can be used as required for wall construction. It would thus be possible to fill in any ground plan in the form and size desired with individual units on the "block building" system, provided the dimensions of the frame are multiples of the selected unit measurement of 1,240 mm., the standard size of the chipboards.

It was found possible to achieve this using a total of only five different types of unit, which meant that they could be simply and economically put into mass production in the future. Figure 2 shows the wall units for a house of approximately 8 x 11 m. ground area, including inside walls. When stacked they

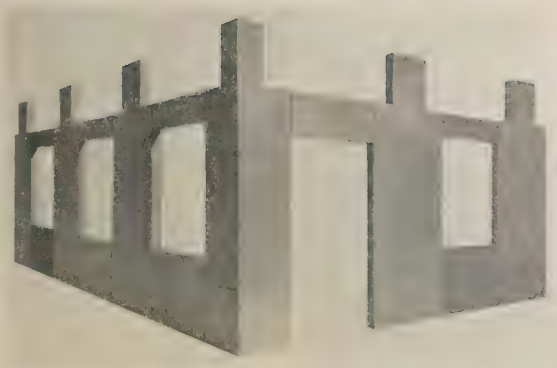


Figure 10. *Corner of a pre-fabricated house composed of walling units entirely made from chipboards*

require a space of only some 18 m³, and can therefore be easily transported on a single truck and trailer.

To protect the external surfaces of walls made of chipboards against moisture, an Institute in Germany has developed a paint whose special features are its exceptional elasticity and absolute durability, even in moist heat conditions. This paint should provide as complete as possible protection of the boards against the penetration of moisture, so that swelling in thickness is also practically eliminated.

The treatment and processing of bamboo material, which was used in part for the manufacture of the chipboards and in the form of plaited mats for the inner layers of such boards, is not dealt with in this article.

Promise for the Future

In conclusion, it appears that this technical experiment, the first to be carried out on timbers of tropical origin in this particular manner, has even at the present stage furnished a considerable amount of valuable knowledge and experience. It has also given rise to many problems which can only be solved by further scientific research.

In any case, the results so far obtained justify the hope that, with the help of the techniques described, it will be possible to effect a more intensive utilization of certain tropical forests, and at the same time help to relieve the housing shortage in Burma. There also appears to be justification for the expectation that these experiments will also point the way to the solution of identical or similar problems in other tropical areas.

As an immediate result of this testing scheme which has been performed in Europe, arrangements have been made for a complete seasoning and impregnation pilot plant to be delivered to Burma in order to carry on research work on an industrial scale on the spot.

Eucalyptus Study Tour

by FAO Staff

The Conference of the Food and Agriculture Organization held at Rome in 1951 requested the Director-General to endeavour to organize a Eucalyptus Study Tour in Australia, financed in part from the funds of the Expanded Technical Assistance Programme.

After an agreement had been successfully negotiated with the Government of the Commonwealth of Australia, invitations were issued to Member Nations likely to be interested. Each country was invited to send not more than two participants, who should be senior officers of forest services or commercial enterprises, having a working knowledge of the English language. The Commonwealth Government assumed responsibility for all technical documentation, lecturing staff, travel and accommodation arrangements, while the co-operation of the six State Governments and of numerous commercial firms was essential to the organization of the tour. For all this assistance and hospitality the participants passed a vote of thanks at the end of the tour.

The response of Member Governments to this invitation was evidence of the wide interest taken in this project and resulted in a much larger party than was anticipated. Thirty-four participants from 24 countries[1] assembled in Canberra, Australian Capital Territory, on 1 September 1952 and the tour formally concluded in Sydney on 28 October.

Figure 1 - *Regrowth of* Eucalyptus maculata *on Bodalla State Forest, New South Wales. The area cleared was filled with trees from seed.*

Objects of the Tour

The main purpose of the tour was to familiarize participants with the great wealth of eucalypt species in Australia and their adaptability to diverse climatic and soil conditions.

The detailed objectives may be summarized briefly as follows:

1. to study the natural occurrence of Eucalyptus species in Australia;
2. to obtain particulars of the silviculture of these species, their formations, associations, natural and artificial regeneration;
3. to study growth rates and methods of forest management:
4. to investigate the climatic and edaphic factors controlling the occurrence of eucalypt species;
5. to study the utilization of eucalypt timber for sawn timber, poles, piles, girders, plywood, pulp, hardboard, mining timbers and also of minor forest products such as tannins and oils;
6. to examine methods of logging, milling, seasoning and preservation;
7. to study certain other associated genera and, where possible, coniferous plantations.

It was considered that the opportunity afforded by this tour should enable countries formulating afforestation programmes to determine on a more scientific basis the potential usefulness of Australian species for their particular requirements.

It must be stressed that it was never intended that this two-months' tour should constitute an intensive or exhaustive survey, but that the period would, of necessity, be occupied by a general appreciation of the genus as a whole and would enable experienced participants to use this background for the selection of species and the evaluation of technical literature.

Conduct of the Tour

The Forestry and Timber Bureau of the Department of the Interior was designated by the Government of Australia as the organization responsible for the conduct of the tour.

The tour was officially opened by the Rt. Hon. R.G. Casey, Minister for External Affairs, and commenced

[1] The countries represented were: Argentina, Belgium, Belgian Congo, Brazil, Burma, Cambodia, Chile, France, Indonesia, Israel, Italy, Jordan, Kenya, Laos, Libya, Malaya, Netherlands New Guinea, New Zealand, Nigeria, Spain, Thailand, Turkey, U.S.A., Venezuela.

with an Orientation Week at the Australian Forestry School, Canberra, covering introductory lectures and field work.

The programme included visits to all States, excluding the Northern Territory, and covered all major forest types with the exception of the North Queensland rain forests. An insight into the activities of the forest products research laboratories of the Commonwealth Scientific and Industrial Research Organization was provided by a three-day visit. In addition pulp and paper mills, hardboard factories, wood distillation and tannin extract plants, sawmills, sleeper mills, and a handle factory were inspected.

The tour covered approximately 5,000 miles (8,000 km.) of air travel and a similar distance by road.

Silvicultural Observations and their Possible Applications

The twenty-four countries represented in the Group extended over an extremely wide range of environments, and each country had in view one or more definite objectives which might be achieved by planting *Eucalyptus* species. The extensive travel necessary to cover as complete a range of *Eucalyptus* species as possible and the limited period available did not permit close study. The following observations are therefore general rather than specific.

Biology and ecology

The Group was impressed with the work being done to facilitate identification of *Eucalyptus* species, varieties and hybrids. The need for effective aids to identification is even more urgent overseas, where geographic occurrence, a powerful aid in Australia, is of no assistance.

Examination of the forests enabled individuals to widen their knowledge, hitherto derived mostly from the literature on the subject of the *Eucalyptus* formations, viz: mallee, savannah, woodland, dry and wet sclerophyll forest and rain forest.

A most important feature is that some species are found exclusively in one of these formations while others are found in more than one. There are some plastic species, each of which may constitute a cline or comprise a number of disconnected races. Inadequate as present knowledge of racial variation within the most important *Eucalyptus* species may be, the existence of such variation must be taken into account in seed collection and species introduction programmes.

The chief benefit derived from the tour concerns the choice of species. Direct observations of species in their own environments should greatly facilitate the choice of those with desired silvicultural and technical properties or capable of forming protective cover. For example, mallee species, though of slow growth and poor form, may be valuable in arid countries for soil stabilization, windbreaks or the production of poles, fuel, essential oils or tannins. The high altitude species, particularly those of the ash group, appear to merit trial in temperate climates. The choice of species for regions where temperature and precipitation are less significant factors has been widened by local observations and from the information supplied during the tour.

A problem which attracted the attention of the participants was the influence of *Eucalyptus* stands on the soil. Except in the wettest type of forest there is very little accumulation of litter and humus and it appears desirable to determine whether or not the artificial establishment of an undergrowth may be beneficial. Some Australian *Acacia* species might be tried for this purpose.

Figure 2 – *A thirty-five to forty years' old stand of* Eucalyptus grandis *on Manning River National Forest, New South Wales.*

Growth

Data on the growth of *Eucalyptus* species both in Australia and elsewhere are inadequate and not always comparable. There is, however, evidence that growth of a number of species is more rapid in some overseas countries. It was suggested that in addition to differences of environment the absence of natural enemies, particularly insects, is a contributing factor.

Natural regeneration

The three systems of working *Eucalyptus* forests that were seen were a single tree selection system, a group selection system and a system of clear felling leaving scattered seed trees. The tree selection system appears to be the least suitable except for tolerant species or for dry sites.

Natural regeneration of *Eucalyptus* is very easily obtained after clear felling, opening of the canopy, or after fire, either by seed or coppice. The reduction of the undergrowth by fire or exploitation may make an important contribution to the successful establishment of such regeneration.

Fire is a grave problem in Australia. It is used in grazing practice and in clearing for land settlement but is a serious hazard to standing timber. Used with great caution it can be beneficial in securing regeneration in Australia and possibly in other countries. While most *Eucalyptus* species have the power to recover after fire, some have not. It is probable that in many countries outside Australia this important consideration and the significance of ligno-tubers in securing regeneration are not fully appreciated.

From the great density of the crops of regeneration, mostly even aged, it is reasonable to suppose that thinning is necessary to secure optimum growth. More thinning studies are required.

It has been observed that in the ecotone between rain and *Eucalyptus* formations, the rain forest species invade *Eucalyptus* forest, and form in many cases, a dense understorey interfering with good eucalypt regeneration.

Plantations

The establishment of *Eucalyptus* plantations using tubed or potted stock presents little difficulty in Australia. Successful plantations resulting from direct sowing, for example *E. astringens*, were seen. These methods have possibilities in other countries.

The plantations of *Araucaria cunninghamii* in Queensland and of *Pinus radiata* in South Australia were impressive. Softwood plantations are likely to fill as important a role in Australia's timber economy as *Eucalyptus* species do in many other countries.

The striking results of application of phosphates and zinc salts in securing healthy growth of *Pinus* species on *certain soils* in Australia are of world wide interest and merit careful study in other countries.

Protection

Little information on the incidence of damage to *Eucalyptus* species by insects and other pests was available to the Group. It is desirable to draw attention to the necessity for guarding against the introduction of Australian pests of *Eucalyptus* into other countries.

The Group was impressed with the measures now being taken to guard against repetitions of the very serious forest fires which have taken place.

Utilization Section

Utilization practices seen during the tour varied from the most primitive and wasteful to the most highly organized and efficient. The adoption in any country of any practice seen must depend in general on the particular combination of present and potential *Eucalyptus* resources, other timber resources and the degree of industrial and economic development of that country.

Although the small scattered units of Australia's forest industries are mainly of low individual productivity, their prevalence has the off-setting advantage of permitting a surprisingly high level of silviculture and forest productivity for such a relatively undeveloped country. This point may be worth careful consideration elsewhere.

Perhaps the most instructive feature of the tour from the utilization point of view was the visit to the Melbourne laboratory of the Division of Forest Products of the Commonwealth Scientific and Industrial Research Organization. The Group was most impressed by the happy balance between basic and applied research achieved and found that the talks and demonstrations presented by the staff served to bring the whole tour into perspective. The following impressions are grouped by class of product.

Lumber (sawn timber)

The studies of seasoning and the phenomenon of collapse in drying conducted by C.S.I.R.O. and the reconditioning treatment developed to reconstitute collapsed timber are of broad significance. The generally good qualities resulting from the application of this treatment in the ash group of eucalypts have been realized in Australia only in recent years and are not yet sufficiently appreciated in other countries where these species may be grown.

The close utilization of small dimension conifer thinnings to produce flooring and case lumber was especially interesting.

Fuelwood, charcoal and distillates

Production of charcoal and wood distillates, as seen at Wundowie, Western Australia, is of interest to countries suffering from fuel shortages. The possibility of using mallees for firewood production or for the distillation of *Eucalyptus* oils from the leaves may have application in semi-arid countries.

Posts and poles

Observations made during the tour should enable the selection of species to produce more durable transmission poles than those used at present. It was, however, noted that there was a tendency towards preservation of *Eucalyptus* in the round, and the technique of treatment of power poles is significant in this respect.

Tannins

Eucalyptus astringens, the bark of which contains up to 40 percent of tannins and which, with an annual precipitation of 20 inches (500 mm.) or less, produces crops of bark on a short rotation as well as a timber of great toughness, is of potential value in areas with slight rainfall.

Hardwoods

In view of the housing needs in most countries, much interest was taken in the production of hardboard. The Asplund process plant seen at Burnie, Tasmania, is notable for its utilization of wood waste, and the Masonite plant at Raymond Terrace, New South Wales, for the complete utilization of mixed forests of low quality.

Paper

The three paper mills seen, using respectively mechanical, soda and kraft processes, showed the possibilities of making high quality paper of many types from pulps produced wholly or partly from the relatively short fibered *Eucalyptus* wood. The market for small conifer thinnings provided by this industry is of general interest.

Before the participants dispersed, a short report was drawn up summarizing in general terms what had been seen. A number of suggestions were made to FAO and to the Australian Forestry and Timber Bureau on possible follow-up action.

The Charcoal Problem in Asia

by E.E.F. Uhart,
FAO Technical Assistance Officer, Iran

Outstanding in forest utilization in those Middle or Far Eastern countries that receive technical assistance from the United Nations is the substantial amount of wood used for charcoal as compared with the relatively small amount of saw timber extracted. This is characteristic of Iran and Syria, Turkey and Iraq and is also found on a smaller scale in Pakistan and India (where wood is more normally used for fuel); but towards China and neighboring countries, it is seen once more at its worst. Here, a partially burnt charcoal is used for cooking; it burns slowly, but is troublesome because it smokes.

Charcoal-burning is also practised throughout the Malay Peninsula, Thailand and Indochina, where it plays an important part compared with saw timber extraction which is carried out on a modest scale in relation to existing forest resources. In all these countries charcoal production is primarily intended for local consumption and is only occasionally exported to adjacent regions.

What we shall proceed to describe for Iran will apply with slight variations to the countries mentioned above.

One instance is enough to illustrate the point: Iran, according to official statistics, annually consumes 400,000 metric tons of charcoal made from roughly 4,000,000 m³ of wood, whereas saw timber extraction only amounts to 200,000 m³, one-twentieth of the volume converted into charcoal.

Uses of charcoal

This extensive use of charcoal is due, in the first place, to methods of cooking (grilling mutton over hot coals) and heating. These methods came to be employed because complicated stoves are not necessary for burning charcoal, which is an inexpensive fuel, easy to use and available wherever there are forests. They date from the time when a fire, still a rarity, could be kept alight by live charcoal embers underneath the ashes.

The switch-over from charcoal to oil or coal will be a long and difficult process because of the high price of the latter and the difficulty of transportation over bad roads.

Finally, it is significant that Tehran, with a population of 1,200,000, consumes 200,000 tons of charcoal a year, half the country's total consumption, despite the concurrent use of oil, fuelwood and coal.

Climatic conditions and forests of Iran

On the whole, Iran has a dry, continental-type climate with the exception of its coastal areas, notably the Caspian area, which has a good rainfall. This has given rise to two large forest zones:

1. North Slope of the Caspian area, where rainfall is heavy (1-1.50 m. per year) and where there are also snowfalls. On account of its climate this area still has some fine forests with species of a Caucasian-European type, the most important of which are: *Quercus castaneifolia, Parrotia persica, Fagus, Ulmus, Fraxinus, Carpinus, Populus, Buxus, Juniperus,* etc.
2. Remainder of the country, where rainfall is low (from 400-120 mm. in the south). Here *Pistacia lentiscus* and, in particular, *Quercus persica*, predominate, the latter an excellent drought-resistant species adapted to the climate of the region, which grows well from stumps.

The first area, which includes mature trees and stands which have deteriorated through widespread grazing and uncontrolled charcoal burning, still possesses timber worth extracting.

The second area, on the contrary, needs to be made a reserve area immediately, with the sole object of protecting the existing forests on account of the general paucity of timber. Only when these forests have been rehabilitated can good forest management be undertaken.

Charcoal-burning methods and their drawbacks

Confining ourselves to Iran — since the same methods are employed in the other countries — the systems of charcoal-burning can be reduced to two.

In the Caspian and Azerbaijan forests, stone and earth kilns are used; these are roughly put together with faggots and billets under a vault of beaten earth, and are for the most part protected by a rough roof from rain and storm. The capacity of the kilns varies from 3 to 10 or 15 m³ of wood and they are filled through openings at both ends of the covering vault and emptied of charcoal from below, with 1 to 3 vents to assist the draught.

In the Shiraz area the system is even more primitive and consists in digging a pit in the ground, reinforcing it inside with flat stones, particularly on the side with the opening, to avoid it caving in. Wood is cut in 50 cm. lengths and stacked alongside the opening. The pit is fired by dropping burning kindling into the hole and covering it with the wood. The hole is then covered over with a lattice of billets ("charbonettes" - small logs not over 66 cm. in length) which act as a support for a covering of damp earth which is applied when the fire is put out.

There is no need to dwell upon these primitive ovens which are found with slight variations in Asia, Africa and Latin America. The Chinese type, for instance, consists of a hole dug in the ground, sometimes with stone walls, with a slanting door for loading and unloading and several openings for the draught.

The principle is the same: the wood is charred, that is to say, a part of the wood burns slowly and gives forth enough heat to distill the remainder and convert

Left, Iranian kiln in the Caspian region, showing the two openings through which the kiln is stoked; note the trench from which the kiln is emptied and the charcoal put into sacks. Right, a similar kiln without roof: a forest ranger points to the opening through which the kiln is emptied.

it into charcoal. It is all a question of experience and personal skill. In order to obtain good charcoal, the burning must be stopped when all the wood is charred and, above all, the pit must be hermetically sealed.

From a practical forester's point of view, there are three drawbacks common to all these methods of charcoal burning:

1. The charcoal yield is very poor — about 10 percent — which means that a great part of the wood burnt is a total loss. The optimum yield varies between 22 and 25 percent by weight of the charred wood (distillation in a retort).
2. Methods of working the forest are poor; the woodcutters have poor equipment and as a result do not make full use of the timber. Generally, they only take the branches up to 25 cm. in diameter, and leave the trunks to rot on the ground. The trees are either uprooted or, more usually, cut at 1 meter to 1.50 meters from the ground, with the result that no new shoots sprout and the forest disappears.

   Present felling methods destroy the existing forest without making full use of its wood and absolutely prevent regeneration by shoots.
3. In most of the countries under consideration, charcoal-burning places are badly located and choice of site is completely uncontrolled. This involves destruction throughout the stands and the resultant disappearance of the forest, especially where there is unrestricted grazing and shifting cultivation.

   Erosion removes the top soil from the slopes and exposes the rock; and, in the tropical regions, laterization takes place, with all its consequences.

This gloomy picture is no exaggeration. Its truth can be checked by flying over the Middle East countries, the Deccan Plateau in Central India, or China.

Technical remedies

Although this section deals more particularly with the action taken in Iran, the remedies found useful there can serve in others with minor changes.

1. In order to increase the charcoal yield to a reasonable level, it has been suggested that the local kilns be replaced by mobile metal ovens of the *Magnein-Tranchant* type. These have the advantage that they can easily be made locally and even unskilled labor can be readily taught to handle them; but, more important, their average yield varies between 18 and 20 percent. This, in theory, would reduce wood consumption by half. The charcoal obtained from this type of oven is of better quality, since it is completely charred and burns out for lack of oxygen instead of having to be put out with water, as is too often the practice.

   The cost of manufacturing these ovens in Iran is at present 1,000 Tomans (U.S. $125) per unit. They should be used in a set of four, operated by ten men. Their average service life is two years. Taking into account the depreciation over this period, the additional profit from each set of ovens is 3,000 Tomans. Moreover, the quantity of wood consumed would be approximately twice as small as by the old method in order to produce the same quantity of charcoal.
2. Felling would be improved by the use of simple but good quality hand tools: axes, billhooks and cross-cut saws for bucking, and metal wedges and sledge hammers for splitting trunks; the use of such tools would make it possible to fell trees efficiently and, above all, at ground level. This latter practice would ensure stand regeneration by stool-shoots in the form of coppice or coppice with standards. Further, a cutting cycle needs to be established for all forested areas; in the case of the Caspian forest, this would be 10 years.

   The advantage of this would be to limit charcoal production to low altitude forests (those below 500 m.), the others being reserved as high forest fulfilling a protective role both as regards climate and for preserving soil water, in addition to constituting a source of timber. We are convinced that the coppice system will also contribute to soil conservation, on account of the closeness of the stand, and will at the same time have a favorable effect on the improvement of water regimes, although the amount of water evaporation which takes place in a deteriorated high forest, as compared with the coppice which replaces it, is always a debatable point.
3. In order to concentrate charcoal-burning activities and make their supervision easier, sound legislation needs to be enacted and enforced, above all, to limit charcoal-burning to carefully chosen areas, with due regard for supervision and transport facilities (roads) and the comparatively low density of the stands.

These suggested remedies would probably have to be varied for other countries in the light of economic conditions (consumption and transport facilities), while remaining generally very similar. In the more highly developed countries, for instance, stationary metal or masonry ovens could be erected and supplies of wood

brought either by road or by water. Apparatus could be added for the recovery of by-products, which have a high market value when available in large quantities. Among the by-products which could be put to immediate use are tar to provide creosote for impregnating railway sleepers and telegraph poles, and acetic acid in the form of lime acetate for dyes for the textile industry.

Felling could be partially mechanized by the use of band-saws, and haulage improved by cableways.

Legal and financial planning

The implementation of such a plan, which would entirely revolutionize local customs, would require the full support of government and public opinion.

Legal and financial planning would obviously vary according to the existing forms of forest ownership, social conditions and the financial resources of the particular country.

The legal structure would need to be either a state enterprise, a co-operative system where holdings are small, or private enterprise.

In the author's opinion, the first of these would be most suitable for Asia; that is, the establishment of state-controlled charcoal-burning companies managed by competent forest service agents, but financially independent. They would be state trading monopolies.

The funds that would be needed to finance them could be raised in several ways. The time required for carrying out such a plan would naturally vary according to the country — in the case of Iran, ten years.

The profits from such enterprises would be used to equip the forests with roads, houses for rangers, sawmills, plantations, etc.

Conclusion

In this rapid survey an attempt has been made to stress the widespread nature of the charcoal problem. Similar drawbacks require similar remedies. Briefly, by introducing modern ovens a better yield will be obtained. The forests will be managed, thus ensuring their conservation and a better return. Forest conservation will indirectly affect the climate and the soil's water resources and will also help to check erosion. The zoning off of charcoal-burning areas will make it possible to utilize the other forest areas — as, for example, montane forests — for other purposes such as protection and the production of saw timber. The improvement of the latter will assist the rational utilization of industrial wood to feed both the home and export markets.

One example is worth quoting: as a result of the establishment of a charcoal-burning center in Cambodia at the village of Dang Tong, a mixed stand with a preponderance of "sralao" (*Lagerstroemia*) was converted valuable teak (*Tectona grandis*), after the other species had been removed. A small sawmill used the "sralao" for making boards and building timber.

This is an example to be followed and it is reasonable to conclude that, with proper charcoal-making arrangements and practices, the population can be kept supplied with charcoal and the tropical and subtropical forests enriched with valuable species, thus helping to meet timber shortages and to raise standards of living.

Kiln in the Shiraz region: above, out of action; below, in action.

Below, metal oven and regenerators of local manufacture at the Agricultural University of Karadj (near Tehran).

India's Declaration on Forest Policy

by FAO Staff

On 12 October 1894, the Government of India published an official document outlining the forest policy which it proposed to apply in the management of the country's public forests. This was a notable step. Many European countries had indeed been following established forest policies for centuries, but none seems to have taken the trouble to give official public expression to the underlying principles.

The fact that the present Government of India has thought fit to issue a new declaration of forest policy does not mean that the fundamental principles on which the 1894 declaration was based have been modified. In fact, those who have framed the latest document do not seem to consider that any further legislation for implementing the new policy is necessary. The existing Indian Forest Act remains in force unaltered in all the States where it is already applied, and the Declaration of 12 May 1952 recommends that the other States extend it in their territories. It is, therefore, only to the spirit in which the old law is to be implemented and to the objectives which it must pursue that the present declaration will give a fresh adjustment.

The new orientation

As is emphasized in the declaration of 12 May, it would be a mistake to attribute this new orientation only to political changes in India since 1894. The declaration says: "The part played by forests in maintaining the physical conditions in the country has come to be better understood", which means that the forests are better known and that much progress has been made in silviculture and methods of timber utilization.

Before describing the new orientation in India's forest policy and analyzing the main points in the declaration of 12 May 1952, it is as well to note that its importance for India rests essentially in the unanimity with which it was adopted.

The vast sub-continent comprises many States with varying climatic as well as political, economic and social conditions. Early in May 1951, the Federal Forest Service submitted a draft declaration to a special meeting convened at Dehra Dun, to which FAO had been asked to send a representative. This meeting was attended by foresters, senior administrators, and Ministers of Agriculture and Forests from all the States of India. Agreement was not reached at once, and it was only subsequently, after a year's careful study by high officials, that an agreed text could be adopted as India's new declaration on forest policy.

The new declaration applies to all the forests of India, irrespective of ownership, and no longer only to forested State lands. That, however, is but a detail. The spirit of the new declaration differs essentially from the old in two noteworthy respects both based on the idea that forest is a national asset that must be so administered as to benefit the country as a whole, all other considerations taking second place.

Forestry's just claim to land

First, the declaration of 12 May 1952 opposes "the notion widely entertained that forestry, as such, has no intrinsic right to land but may be permitted on suffrance on residual land not required for any other purpose". No doubt in 1894, in the face of the crying need for increasing agricultural production, priority could be given to requests for land clearance which aimed at increasing the area under cultivation. True, the old policy admitted of some limitation of this principle but the obstacles which it placed in the way of land clearance were readily circumvented, and this not only conduced to the destruction of forests from which local populations should have obtained their timber and fuel but "also stripped the land of its natural defences" against erosion by wind and water.

What, under the new policy, will be the future distribution of land between agriculture and forest? The needs of agriculture are admittedly no less in 1953 than they were in 1894; in fact, they are greater by far. But experience has shown that they must not be satisfied by indiscriminate extension of agriculture at the expense of the forest, and that the solution should rather lie in an intensification and improvement of farming methods which can only be possible on soil properly protected from erosion and where the farming community has assured supplies of fuelwood and timber. In other words, the distribution of land between agriculture and forest must be based on "a system of balanced and complementary land use under which each type of land is allotted to that form of use under which it can produce most and deteriorate least".

Careful utilization of forests

The second aspect in which the new policy is distinguished from the old is the strict restriction placed on the utilization of the forest by near-by communities. "The accident of a village being situated close to a forest does not prejudice the right of the country as a whole to receive the benefits of a national asset". Conservation and rational utilization of a forest obviously require the strict observance of certain rules. "While, therefore, the needs of the local population must be met to a reasonable extent, national interests should not be sacrificed because they are not directly discernible, nor should the rights and interests of future generations be subordinated to the improvidence of the present generation".

Classification of forests

The new forest policy declaration sets out a functional forest classification, purely with a view to concentrating attention on the *main* function of each particular area, and in no way at variance with the Indian Forest Act classification which is based on the degree of management to which each stand is subjected.

The declaration is careful to distinguish between:

(*a*) protection forests;
(*b*) national forests;
(*c*) village forests;
(*d*) tree-lands.

The first three are self-explanatory. The fourth is new and is defined as "those areas which, though outside the scope of ordinary forest management, are essential for the amelioration of the physical conditions of the country".

It is intended mainly to cover artificial plantations, sometimes no more than a few trees which the farmer plants by his field. These woodlots, though they are technically within the responsibility of the Forest Service, could not possibly be created by it by reason of the very size of the task involved, which in fact requires widespread public support that can only be engendered by all officials concerned lending their active support to such a tremendous undertaking. The Indian Government does, in fact, envisage the planting of 30 million trees in 10 years. But the declaration estimates that 2,000 million are needed to "restore the hydrological nutritional balance of the country", without regard to the additional benefits that villagers could derive in the way of fruits, forage and timber from field and strip plantings in purely farming areas, where lack of trees is often a real tragedy.

The declaration points out that the implementation of such a plan is not an idle dream. The success of the "Vana Mahotsava" (Festival of the Trees) already provides eloquent proof of this, which suggests that the Indian Delegation was on firm ground at the last session of the FAO Conference, in proposing the celebration of a "World Festival of the Trees" whereby all Member Nations of FAO that still had no annual ceremony for developing public consciousness of forest values, should forthwith take steps to institute such ceremonies.

Control of private forests

The declaration of 12 May 1952 recommends that all Indian States in which private forest ownership is still of some significance should arrange for strict control of private forests "so that the indiscriminate exercise of individual rights may not prejudice or endanger the general welfare".

Control of the nature which the declaration has in mind is already being exercised in several States and it recommends the general application elsewhere of the systems which have proved successful. These entail compulsory subjection of private estates to management plans approved by the appropriate authorities, but limit by law the instances where the authority concerned may assume direct responsibility for management to cases where the owners are "tempted to sacrifice their capital for immediate gain".

Income from the forest in any case remains with the owner. But should present arrangements prove impractical or fail to arrest destruction or overfelling of private forests, the Governments of the States are encouraged to introduce legislation enabling them to assume ownership of essential forest stands which appear to be threatened with extinction.

The grazing problem

The problem of grazing is one of the more important and difficult matters confronting India's foresters.

It is well known that, because of the large number of animals retained by farmers, many of them having no economic value, there is continuous pressure for permission to graze in the forests near villages, to an extent far in excess of the forest's grazing capacity. This means a continual drain on resources and a potential danger to the forest stands and forest soil.

"Speaking generally", says the declaration, "all grazing in forests, particularly unlimited or uncontrolled grazing, is incompatible with scientific forestry".

Whatever original characteristics of its own Indian forestry may have acquired over the years, it remains the offspring of Western European forestry and such a sentence amply betrays this relationship. The idea behind the sentence might be more correctly expressed if it were said that all unlimited or uncontrolled grazing in forests was incompatible with the rational conservation of natural resources, which is true not only of grazing in forests but of grazing on all types of land. There appears to be a slight contradiction between this part of the declaration and a statement elsewhere that among the vital needs of the nation which justify the forest policy enunciated is the need for increasing grazing resources. The third class of forests, namely the village forests, are in fact defined as forests which have to "provide *inter alia* grazing for livestock".

Under the circumstances, it might have been more logical to recognize that at least some Indian forests, like those of many other regions, lend themselves to multiple use, of which grazing is one use of particular importance under present social and economic conditions in India, but that the use of the forest for grazing, like all other uses, must be strictly controlled and limited.

This, in fact, is the policy recommended by the present declaration and it deserves whole-hearted approval. It calls for the imposition of the regulations necessary, but accompanied by efforts to demonstrate to farming populations the ultimate benefits which will undoubtedly accrue. It requires the imposing of a "reasonable fee" for the privilege of grazing in respect of each animal involved, for "cheap forest grazing has a demoralising effect and leads to the vicious spiral of reckless increase in the number of cattle, inadequate forest grazing, reduced quality of the herds and further increase in the numbers to offset the fall in quality".

Sheep grazing must be very strictly controlled. As to goats, "special forest reserves under strict rotational control" should be created for them.

The principle of sustained yield

The declaration naturally stresses the principle of sustained yield and its application through carefully prepared working plans for all forests. It advises each State to set up within its forest administration a special service for the development of such plans, that is to say, for "their compilation, and revision and deviations from them, research and statistics, as well as to conduct detailed surveys of available forest resources which are a *sine qua non* for a sound forest management".

Other provisions

The declaration covers all the other relevant aspects of forest policy but naturally leaves to the discretion of the individual States the way in which they should work out their own policies within the framework of the general principles, so long as this is consistent with the higher national interests.

Mention is made of the close liaison that should exist between forest industries and foresters, particularly as regards research, but the declaration does not seek to lay down a policy of development for such industries. As things are in India today this is natural enough, because it is rather at the State level, and even at the level of each individual forest, that such a policy can be worked out. Local conditions are too varied for a national declaration to be anything more than very general, to the effect that there is need for developing wood-using industries and that developments should keep pace with the development of forestry and forest production.

Of other recommendations in the declaration to which reference has not yet been made, special attention may be drawn to forestry education. Despite the diversity of local conditions, the declaration commends centralization of training for higher grades of forest officers and for forest rangers in the forest institutes and colleges at Dehra Dun, and emphasises the desirability of "inculcating an *esprit de corps* among forest officers, of developing a common outlook in forestry matters, and of ensuring concerted and integrated policies throughout the country".

There is also a paragraph on forest budgets where the creation of a sinking fund independent of the budget is recommended, such a fund to be constituted by investment of a part of the revenues from the forests, more particularly during prosperous years. There is a warm recommendation that co-operatives of forest workers should be formed. Apart from their social and professional value, such associations help greatly to develop consciousness of forest values among rural populations. "Once the local population learns to look upon the forest as a means of its livelihood, a great step forward will have been taken".

It was said at the beginning of this article that the document, published on 12 May 1952 by the Central Government, was of great importance to India. It may be said in closing that the declaration is also of importance from a regional and world standpoint.

At its Sixth Session in Rome, the FAO Conference recommended that all Member Nations put into practice the general "Principles of Forest Policy" which had been at that time formally adopted. Many countries, fortunately, have honored these principles over the years, yet a careful perusal of the Conference resolution may perhaps reveal certain difficiencies that could be made good.

India, however, is the first country which, through the voice of its Government, has adhered officially, explicitly and entirely to these principles.

International Union of Forest Research Organizations

11th CONGRESS, ROME 1953

Following the generous invitation of the Italian Government, the I.U.F.R.O. will hold its Eleventh Congress at Rome and in Sicily from the end of September until the middle of October 1953.

The scientific discussions will include the following topics:

- Protective influence of shelterbelts.
- Delimitation of vegetation areas according to climate.
- Principles to be used for classification of vegetation.
- Provenance tests and forest tree breeding.
- Grading of stands for thinning.
- Silvicultural methods and possibilities for preventing pests and diseases.
- Rapid determination of increment.
- Growth and yield in unmanaged and managed forests.
- Forest valuation.
- Techniques and terminology of work studies.
- Influence of diameter growth on the technical properties of wood.

Representatives of the forestry sciences of all countries, as well as their wives, are cordially invited to participate in this Congress.

The Congress will meet for 4½ days in Rome, followed by a study tour of 8 days in Sicily. Most of the scientific discussions and administrative meetings will, by agreement with FAO, be held in Rome. The study tour in Sicily will deal principally with the great afforestation work in progress there, with the grouping of the natural forest vegetation according to height above sea level, especially on Mt. Etna, and with tests on the cultivation of various exotic tree species.

The individual subscription fee, which also entitles the subscriber to a volume of the proceedings of the Congress, will be about 6,000 Lire. Ladies will not pay any subscription fee.

Scientists who are not members of the Union may participate in the scientific discussions in Rome on payment of this fee. They should inform the chairman of the organizing committee, Professor Aldo Pavari, Via delle Cascine 1, Florence, Italy, as soon as possible of their intention to participate. The study tour in Sicily, however, will be reserved for representatives of member institutes, associate members and their wives.

The organizing committee will take care of the hotel reservations in Rome. Hotel costs, including meals, will vary between 4,000 and 8,000 Lire a day, according to the category of hotel required by participants. For the study tour in Sicily, a single fee will be payable to the organizing committee to cover all expenses, namely: travel from Rome to Catania (train), travel in Sicily (car), and hotels and meals in Sicily. First or second class hotels and rail tickets will be available. According to provisional estimates, the overall cost will be 50,000 Lire for the former and 36,000 Lire for the latter. The cost of a sleeping-car ticket Rome-Catania is not included.

Silviculture of Lowland Dipterocarp Forest in Malaya[1]

Extracts from a paper submitted to the Asia-Pacific Forestry Commission

by A.B. Walton, R.C. Barnard, and J. Wyatt-Smith.
Malayan Forest Service

The object of Malayan forest management in the silvicultural practices described below is the conversion of the virgin forest containing trees of all ages and sizes (the largest of which are overmature and moribund) and a mixture of both good quality and, at present, unutilisable timber species, into an even-aged forest containing a high proportion of the best quality indigenous timber species. Though even-aged, the new crop will not be even-sized on account of natural variation in growth rates of the different species, genera, etc., and will develop into two or more storeyed high forest with a lower storey of species which do not grow beyond pole size and a natural undergrowth. Intermediate fellings of timber-sized trees will be carried out in the new crop of the shorter-lived species on reaching their technical rotation, together with commercial thinnings of any species. The rotation age of the final crop is expected to be between 60 and 70 years for the rapid growing light-hardwoods and 100 to 120 years for the heavier primary hardwoods by which times the trees will be 6 to 8 feet (1.8 to 2.4 m.) girth above buttresses.

Natural Regeneration

The silvicultural system now practised after some 30 years' experience and research may best be termed clear felling over natural seedling regeneration. This short title will bring an incorrect picture to the mind of foresters without experience of tropical rain forest and a short description of the appearance of the forest after felling is necessary to correct this.

The actual felling consists of the exploitation of all timber, firewood and pole trees which the contractor working under felling permit will or can be persuaded to take. The completeness of the operation depends on the proportion of utilisable timber trees in the growing stock, the distance from the market or sawmill and the local demand for firewood and mining or building poles. After exploitation there is always left a number of large overmature defective trees or trees of a species not at present utilisable on account of hardness, silica content or poisonous sap; also trees or poles of valuable or other species below the minimum exploitable girth limit for timber (now about 4 ½ feet or 1.4 m. girth but varying with local timber demands) which cannot be exploited owing to species, form or market conditions. When, therefore, exploitation has been completed according to present standards in Malaya, there may be half or more of the growing stock still standing, an undergrowth of woody species and palms and a tangled mass of crowns and branches.

Standing trees and poles down to 2 inches (5 cm.) diameter (except those of timber species which are of good form and undamaged) are poisoned either progressively as felling is completed or over the whole compartment immediately afterwards, before the extraction tracks become overgrown. A number of the poisoned trees will be dead within a month or two and a high percentage by the end of a year, while a few will remain alive due either to faulty treatment or to the species being unaffected by poison girdling.

A year later there will be a very dense re-growth of innumerable species, mostly high forest forms with some secondary growth species up to 15 feet (4.6 m.) tall entangled with woody and herbaceous climbers; and standing over this will be the dead poisoned trees already starting to drop their branches and a few stems of timber species of pole to young tree size usually responding vigorously to full light. Thus Malayan "clear felling" is a mixture of felling and poisoning, and the ground is by no means "clear" at any time during the operation except in the immediate vicinity of felled stems and along the extraction tracks.

This system has been evolved from a cautious shelterwood system with several successive seeding fellings at intervals of a few years, partly on account of the development of exploitation methods from selective hand sawing (with single buffalo extraction) to sawmills (with lorry, light railway and winch extraction), and partly as a result of research and observations which are briefly summarised in the following paragraphs.

Conditions in virgin forest are ideal for the germination of high forest species and large numbers of seedlings will survive for several years, though development is negligible until the canopy is opened. Good seed years of the more popular timber species (Dipterocarps for the most part) are infrequent, localised and unpredictable, but the large number of species now acceptable for sawmilling has increased the economic seed potential enormously.

Undergrowth, with the exception of certain stemless palms which are abundant in some localities, is comparatively sparse under virgin jungle but, within a few months of partial or complete opening of the

[1] Tropical wet evergreen Dipterocarp forest type. *Manual of General Silviculture for India.* (Champion and Griffith, 1948).

canopy, a very dense growth of woody and herbaceous species and climbers develops. For three to five years this re-growth is so dense that there is small chance of survival for any subsequent seed which germinates; there-after, seedlings appearing in the new crop have little prospect of development without frequent assistance.

Experimental treatment plots have shown that most of the popular meranti (soft-wooded *Shorea* spp.) respond and develop most vigorously when exposed to full overhead light, and other economic species respond similarly.

Results of survey

Observations of areas over which uncontrolled timber felling took place during the Japanese occupation, areas clear-felled for cultivation but never burned or planted, and areas laid flat by wind storms where regeneration received no assistance in the early stages have shown that the dense herbaceous climber stage is ephemeral and that a good stocking of timber species will survive undamaged, develop rapidly and win through to crop dominance without assistance, while slower growing economic species survive as sub-dominants. These areas also confirmed that seedling regeneration must have been present on the ground at the time fellings or wind storms occurred, as no seed-bearers of the predominant timber species remained within seed dispersal range of much of the regeneration.

Some three to five years after a complete opening of the canopy, the re-growth, if left untouched, develops into a dense young pole crop comparatively free of undergrowth. In this stage it is a cheap and easy operation to improve the value of the composition and reduce excessive competition by poison-girdling undesirable stems and cutting surviving climbers.

Thus the essentials for the successful establishment and early development of natural regeneration in Malayan lowland forests are:

(*a*) adequate stocking of seedlings of economic species;
(*b*) complete removal of the canopy in one operation;
(*c*) no tending until the re-growth has passed the dense climber stage and become comparatively clear below the canopy;
(*d*) maintenance of an adequate new canopy to prevent the re-development of climbers.

The first operation in the regenerative sequence, therefore, is to ascertain the frequency and distribution of seedling regeneration of economic species by milliacre sampling which provides figures of the percentage of the area stocked with seedling regeneration, its distribution and its composition. At the same time, a 10 percent or 20 percent enumeration of trees over 14 inches (36 cm.) d.b.h. is done to ascertain the numbers of seed bearers and the volume of exploitable timber available.

During the last three years, milliacre sampling has been carried out over approximately 7,500 acres (3,000 ha.) of compartments at ½ to 2 percent intensity and up to the present time adequate seedling regeneration has been recorded in all cases except a few in Kedah and Perlis where the forest approaches the tropical semi-evergreen type. A 40 percent well-distributed stocking of approved economic species is considered sufficient for prospective successful regeneration. By approved is meant species and genera which can be identified in the seedling stage, are known to grow into acceptable timber trees and to exploitable size, and are not usually hollow when of timber size. Thus the figures obtained give the worst possible picture of regeneration prospects and will always be supplemented by seedlings whose future development is uncertain. The approved list contains, at present, the names of some 125 tree species or genera of Malayan-wide distribution, whereas more than double this number are known to be utilised for timber, and species reaching timber size exceed 600.

This milliacre sampling also records the occurrence of any valuable or locally desirable species to which preferential treatment may be accorded under the objects of management for the working circle. Summaries of typical compartments which have been sampled in this way are given below:

TABLE 1.-TYPICAL SUMMARIES OF SAMPLED COMPARTMENTS

State	Reserve & Compt.	No.	Area, acres	Area, ha.	% sampled	% sample stocked	No. of species recorded
Kedah	G. Jerai	8	275	111	1/2	48	19
Negri Sembilan	Sg. Menyala	10	409	166	1/2	65	23
Johore	G. Arong	81	223	90	1	77	14
Johore	Jemaluang	6	450	182	1	58	16

Not more than 18 months before a compartment is due for exploitation under working plan, milliacre sampling is done and, if the seedling stocking and distribution are satisfactory, the felling permit is issued when due. Trees to be felled are marked progressively over the compartment and poison girdling of unexploited trees and poles carried out as described above, the whole operation being completed within two years, in order to ensure sufficient uniformity in the size of the new crop to enable it to be treated as a whole. If exploitation is prolonged over many years, one part of a compartment might be ready for silvicultural treatment while other parts had not yet been felled. Large compartments may be sub-divided as necessary when the rate of exploitation is too slow.

If seedling stocking is found to be inadequate, a study is made of the frequency and abundance of seed-bearers, as shown by the enumeration of economic trees of exploitable size. If seed-bearers are well distributed, the compartment should be retained untouched, if possible, under plan, until a seed year occurs. If seed-bearers are scarce, postponement of felling is unlikely to result in any appreciable increase in seedling frequency or distribution and the same sequence of regenerative operations is carried out; if insufficient regeneration is established, it may be supplemented by artificial regeneration.

Sampling and treatment

Between three and five years after exploitation the dense re-growth has reached small pole size, passed through the dense herbaceous climber stage and is

comparatively free of undergrowth. If cleaning (i.e. cutting climbers and saplings of useless species and thinning out desirable stems) is done before this stage, as was done in the past, the growth of climbers is encouraged, the spaced-out stems are quickly smothered and, without numerous surrounding stems to support them, frequently broken or bent over by the weight of the climbers. Under these conditions, therefore, cleanings have, to be repeated several times at short intervals before the retained stems form a canopy dense enough to suppress the growth of climbers and became capable of developing into a satisfactory crop.

The density of the re-growth resulting after felling makes it difficult to compile reliable information about the regeneration and the amount of assistance it requires. It is obvious that this information should be obtained before any treatment is started, and to this end linear regeneration sampling was evolved. This has been fully described in *The Malayan Forester*, Vol. XIII, p. 129. Briefly, it consists of recording the species, size and dominance class of the most promising economic stem in each sample unit area and the incidence of climbers and undesirable dominating trees or palms. Analysis of the figures so obtained (usually a 5 or 10 percent sample) gives reliable information on the stocking, distribution, composition, development and competition status of the economic stems in the new crop and provides a basis for tending prescriptions and future management. Again only approved species are recorded as in milliacre sampling of seedlings, and the size classes taken into consideration cover only those likely to occur in the general level of the canopy; small suppressed stems are difficult and expensive to assist, and advanced regeneration which survived the felling is above the re-growth and in no need of immediate assistance.

Between three and five years after felling is completed, 1/160 acre (1/400 ha.) regeneration sampling is done of regeneration between five feet tall and four inches diameter and the first treatment, if necessary, prescribed and carried out. At approximately 10 years after the felling, 1/140 acre (1/350 ha.) regeneration sampling is done, recording stems of 2 inches (5 cm.) diameter and larger, and any further necessary treatment decided or the compartment passed as regenerated.

These treatments normally include some or all of the following operations:

(*a*) cutting all climbers and rotan;

(*b*) cutting stemless undergrowth palms;

(*c*) poison-girdling any surviving useless trees of the old crop;

(*d*) poison-girdling weed-tree species (very fast growing, persistent, " wolf " species not acceptable for timber) and stemmed palms in the new crop;

(*e*) poison-girdling all badly shaped, damaged or diseased stems;

(*f*) selective thinning (by poison girdling) in favour of desirable species where these are subjected to the competition of less valuable forms.

A general undergrowth cutting or elimination of all uneconomic species should never be done; the aim is to remove undesirable competition while retaining as complete a canopy as possible. In the early stages of their development, many desirable species compete in height growth with fast growing and less valuable forms and may reach 25 feet (7.6 m.) in height whilst still only ½ to 3/4 inch (1.3 to 1.9 cm.) diameter. Removal of the surrounding vegetation in the circumstances would be disastrous.

By the time the new crop is 10 years old, further tending is unlikely to be required. Marked commercial thinnings of poles, exploitation (on reaching timber size) of trees which were immature at the time of the final felling and exploitation of species reaching their technical rotation will take place between 20 and 40 years after original felling.

In conclusion, the following table summarises the sequence of operation:

TABLE 2. - SEQUENCE OF OPERATION
(*n = the year in which exploitation commences*)

YEAR	OPERATION
(n — 1½) to n	milliacre sampling of seedling regeneration and enumeration of exploitable sized timber trees
n to (n + 1)	complete exploitation over whole compartment in two years or less and poison girdling of non-utilisable stems and species down to 2 inches (5 cm.) diameter
(n + 3) to (n + 5)	30¼ sq. yds (25 m²) linear regeneration sampling followed by no treatment, one or more of operations such as climber cutting, selective thinning, etc. as described above or supplementary planting
(n + 10)	121 sq. yds (101 m²) linear regeneration sampling followed by no treatment, any of the treatments described above, supplementary planting or passed as regenerated
(n + 20) to (n + 40)	sampling or enumeration followed, if necessary, by a commercial thinning of poles and timber sized trees

ARTIFICIAL REGENERATION

Because of the ease with which natural regeneration of most of the commercially valuable timber trees can be achieved, and the large areas of virgin forest still awaiting conversion, artificial regeneration is unlikely to play more than a subsidiary role in the silviculture of Malaya. Nevertheless, the claims of artificial regeneration cannot be overlooked as a means of improving the stocking of forests deficient in economic species, reclaiming abandoned, degraded and mined land, providing fuelwood and poles in areas where lack of proper land planning has resulted in the elimination of forest over a large area and producing more valuable or larger yields by the introduction of exotics.

In the early days of forestry in Malaya, before the possibilities of natural regeneration were understood,

planting of the primary hardwoods, mainly chengal (*Balanocarpus heimii*), in lines in the forest was carried out over a considerable area, but failure to realise the need for opening the canopy resulted in their suppression or failure and artificial regeneration fell into disrepute. There are also difficulties in the formation of plantations particular to Malaya which are encountered to much less an extent in temperate or seasonal climates.

The difficulties of planting and especially in planning a planting program in Malaya are numerous. Seed years of all but a few species are infrequent and unpredictable, seedfall may occur in any month in the year and, except for certain *Leguminosae*, the seed of few species retains its viability if stored for more than a week. Thus any long-term planning is of necessity restricted to a few species which fruit annually or produce seed which can be stored for several years and to species of which wildings can usually be found in quantity. For other species, two to three months between flowering and fruitfall, followed by four to eight months in the nursey before planting out is the only time in which plans can be made and labour organised, and a general flowering is by no means necessarily followed by a plentiful supply of viable fruit. Furthermore, there is no seasonal growth or resting season; seedling development in nurseries is rapid and they may reach the most suitable size for planting out (for survival and handling) at any time of the year.

Problems of development control

Some control of development by transplanting and wrenching can be effected but it increases the cost per plant. Again, should the plants by good planning or good fortune reach the most suitable size at the time of year when wet weather may, on average, be expected, it is always possible that the rains may not oblige or a drought occur after a short period of rain, with fatal results to seedlings already planted out. There is also no method yet discovered of forecasting the trend of the weather or even what may be expected in the next 24 hours. On the east coast and in the extreme north of the Federation of Malaya, the wet seasons are less unreliable.

Direct sowing has been tried on many occasions but only rarely has even moderate success been obtained. Wilding stock shows considerable promise and avoids expensive nursey work. Little progress has been made on vegetative reproduction, but few timber species seem easily propagated by cuttings.

In the formation of plantations, weather is the principal factor determining success or failure, and in the variable climate of Malaya the amount of rainfall during the critical period must be a matter of luck; planting only when the soil is thoroughly moist, in the first half of the wettest average period for the locality, is the only precaution which the forester can take to reduce chances of failure owing to drought.

Other points in planting technique which have been observed to assist survival are thorough watering of the seed bed before lifting seedlings and special care in the prevention of dessication of the seedling roots. Indications are that seedlings are far less tolerant of exposure of their roots than is customary with temperate species, so seedlings are bundled and their roots wrapped in damp sacking (or packed in damp moss for long journeys) immediately on lifting, and only removed one by one as planted. Planting of seedlings ex-bamboo tubes has been frequently done in the past and survival in trials has been up to 50 percent better than bare-rooted nursery seedlings. Trials are being made of small clay pots (returnable for further use), veneer tubes and soil blocks. Such seedlings are more expensive to raise and transport to planting site, but may cost no more for each plant established or for a minimum established stocking per acre. Yet to be investigated are economics of close planting of wildings and seedlings or wider planting of tubed or potted seedlings, to obtain the same final stocking of established plants.

Variation in planting distances

Planting distances vary with the site type and purpose of the plantation. If there is a good local demand for poles, close planting at 6 × 6 feet (1.8 × 1.8 m.) or 8 × 8 feet (2.4 × 2.4 m.) should enable planting costs to be recovered by sale of poles in the first 15 to 20 years, but this requires large numbers of seedlings which cannot always be raised owing to uncertainty of seed supplies. If planting in secondary growth for timber production, wide spacing (40 to 80 per acre, 100 to 200 per ha.) should theoretically suffice for there is no lack of natural "fillers". The latter species, however, at first rapidly outgrow those planted and are apt to smother rather than nurse their charges which, if spaced far apart, become difficult to locate and much time is wasted during tending.

A layout of 8 to 12 feet (2.4 × 3.7 m.) spacing in lines 33 to 66 feet (10 to 20 m.) apart has proved cheaper and easier to plant and to tend subsequently, but poisoning of fast growing secondary growth stems some distance from the planting lines must be regularly done or an overthead canopy is formed and the line becomes a tunnel. Another method that has been tried is group planting at wide spacing; 5 to 9 seedlings are planted at 4 to 6 feet (1.2 to 1.8 m.) spacing in groups at 11 or 22 yards (10 or 20 m.) intervals giving 40 or 10 groups per acre (100 or 25 per ha.) respectively. The groups provide a reserve against casualties and the several plants afford each other mutual protection and compatible competition.

In the establishment of any plantation, frequent tending during the first five years or so is essential or the plants become overgrown by grass, climbers or woody species and in comparison with natural regeneration, the cost is very high.

The following brief descriptions indicate some of the site types on which artificial regeneration will be required or has been practised.

Land which has been mined by opencast methods is left very broken and pitted with large expanses of sand or gravel tailings, which vegetation is extremely slow to colonise. Few attempts have so far been made to plant on such sites, but it is probable that the first step will be the establishment of a creeping or grass cover to provide some organic matter, stop erosion and improve the micro-climate before pioneer tree species can be successfully introduced: *Casuarina equisetifolia* however shows promise in the early stages. Dredged land is fairly level, can be "slimed" to provide some nutrients and improve moisture-holding capacity and can be drained or irrigated without great difficulty. It

is usually colonized by grass within a reasonable time and grazing follows. It is probable that some of the less exacting secondary growth species could be established successfully.

Land which has been cropped for three or more successive years almost invariably becomes sheet lalang (*Imperata cylindrica*) which is regularly burnt (intentionally, accidentally or spontaneously during droughts) and colonising woody species are destroyed, while the lalang recovers vigorously and spreads into surrounding forest or scrub which is scorched and weakened by the fire. The reforestation of any such areas is dependent upon fire protection which is both difficult and expensive, as several diggings or ploughings are necessary to kill the under-ground rhizomes. Spraying with sodium arsenite will control lalang, but must be repeated at regular intervals indefinitely. In a year or two lalang can be converted to grazing grasses, which do not burn, by means of mechanical cutting, light harrowing and intensive grazing. The cattle eat new young shoots of lalang and other grasses come in rapidly from their droppings. Economic mechanical cutting, however, is only possible on comparatively level land which has been under lalang so long that tree stumps have rotted away. Provided fire protection can be effected, woody species will develop in lalang and several hardy pioneer species such as leban (*Vitex pubescens*) and tembesu padang (*Fragraea fragrans*) can be easily raised and successfully planted; they will kill out the grass by shade in about seven years, after which more valuable species can be underplanted.

Forest which has been cleared for one or at most two crops and then abandoned will revert to secondary growth which, like the re-growth following clear felling but containing few economic species, becomes comparatively clear of undergrowth after 3 to 5 years and can be underplanted, line or group planted, and the canopy opened as desirable by poisoning. Areas of forest in which economic species are scarce, or of re-growth where natural regeneration has failed, can be enriched by planting in this manner.

The establishment of plantations in conjunction with agriculture, such as the Burmese taungya system, has met with little success largely due to lack of suitable agricultural methods. The aborigines take one crop only of hill rice, tapioca, etc., and do no cultivation or weedling; other races growing hill rice may twice weed their one crop, and the Chinese vegetable gardener or tapioca grower builds a semi-permanent house and either continues for ever on good land with intensive pig manuring or continues until the land is so degraded or infested with lalang that further cropping is unprofitable.

Between these two extremes there are no agriculturists who follow a system of progressive clearing and cropping for the introduction of tree species in the second or third year crops which would be tended for a year or two before the land is abandoned. Clearings made for one crop are better if underplanted some years later as explained above. Some planting has been done on Chinese vegetable gardens just before abandonment, with uncertain success. If done too late, no further cultivation is done by the gardener and invasion of weeds and lalang is rapid and, if too soon, most of the seedlings die—owing, it has been suggested, to the baleful looks cast upon them by the market gardener! Except where there has been very close supervision, offers of rewards or payments based upon the number of surviving tree seedlings have not resulted in successful co-operation.

Promising exotics

Of the exotics so far tried the following three show grat promise. *Albizzia falcata* will grow on almost any site excepting pure sand, gives good survival planted as stumped saplings ½ to 1½ inches (1.2 to 3.8 cm.) diameter, is a soil improver and one of the fastest growing trees in the world, reaching a height of 80 feet (24 m.) and a girth of 4½ feet (1.4 m.) in five years. The wood is soft and weak by local standards but is used for matches and has possibilities for paper pulp. The Honduras mahogany (*Swietenia macrophylla*) was planted as long ago as 1876 and has grown well on good and poor sites. Seedlings are easy to raise and planting survival usually good. *Eucalyptus deglupta* is another very fast growing exotic, producing a fair quality timber which has reached 76 inches (23 m.) girth and 105 feet (32 m.) in height in 10 years. Seed is extremely small and seedlings very liable to damping-off unless transplanted from seed pans to seed boxes when at 2 leaf stage. Seed of all these species is regularly available.

FAO Staff Changes

After five years of distinguished service with FAO, D. Roy Cameron has relinquished the appointment of Chief Technical Assistance Officer, Forestry. He has been concerned with FAO and its Forestry Division since the Organization was first founded. Joining the staff in 1947 after being Dominion Forester, Canada, Mr. Cameron headed the European Office of the Forestry Division at Geneva for three years, serving also with great success as Director of the Timber Division of the United Nations Economic Commission for Europe. After FAO Headquarters moved from Washington to Rome, Mr. Cameron assumed charge of forestry activities under the Expanded Technical Assistance Program.

P. Terver, who for the past three years has been Chief of the FAO Regional Office in Rio de Janeiro, has taken over the post vacated by Mr. Cameron.

W. R. Chapline, Chief, Division of Range Research, Forest Service, U. S. Department of Agriculture, has been appointed as a Chief of Section within the Forest Policy Branch.

S. von der Recke, Deputy Chief of the Forest Service of the German Federal Republic, has been assigned to head the Latin American forestry working group.

S.A.Vahid, lately Inspector-General of Forestry, Pakistan, has taken up the appointment of regional forestry officer for the Near East.

Timber Constructions at the Olympic Games

by Heimo Rahtu, Director of Laboratory,
State Institute for Technical Research, Helsinki, Finland

Olympic stadium

Work on the stadium started in 1934 with the construction of the arena comprising a 400 meter race track, jumping and throwing points and a football field measuring 45 × 65.5 meters. Of the reinforced concrete stands designed to enclose the oval, the grandstands and a part of the bleachers providing for a total of 25,000 spectators were made first. Later, when it was decided that the 1940 Olympic Games were to be held at Helsinki, temporary additional wooden stands were built raising the total seating capacity to 62,000 spectators. Owing to the war the Games could not be held and the wooden stands, intended as a temporary measure to be pulled down after the Games, remained in position for a decade and rotted badly.

When it was decided to hold the 1952 Olympic Games at Helsinki these stands were dismantled and replaced by reinforced concrete constructions providing for 50,000 spectators. These permanent stands enclose the arena entirely, and for the purpose of the Games the bleachers were enlarged with wooden constructions so as to give seating capacity for an additional 20,000 spectators.

Since the soil in the area of the stadium varies considerably and is composed of every type ranging from gravel to mud, the supports had to be driven down to bedrock and their upper ends joined with tension bars. The concrete stands are supported by reinforced concrete frames to which the wooden constructions are attached (Figure 1). In making strength calculations, a live load of 300 kg. per sq.m. was taken for the stands of the seated audience and 450 kg. per sq.m. for the standing audience: in addition, some sections were testloaded with soldiers. Materials required for construction of the stadium amounted to: timber – 610 standards; Bufoplates – 90,000; spikes – 31.6 tons. Figure 2 shows the south curve of the stadium from the outside.

On dry days the wooden stands were sprayed with

Figure 1. Shows supporting concrete frames.

Figure 2. A general view of the south curve of the Stadium.

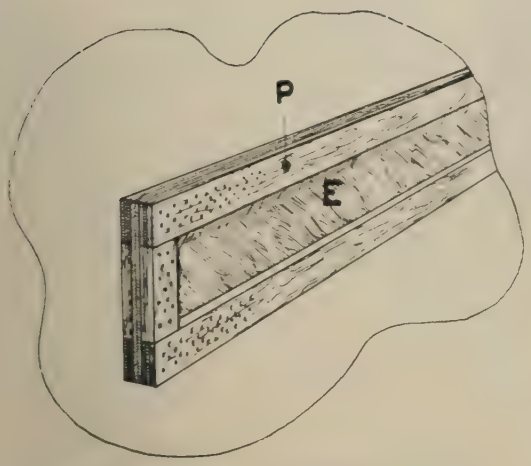


Figure 3. Diagram of the Swedish HB beam.

water before the Games started to avert danger of fire, and, in fact, they sustained no damage in the course of the Games. No final decision has yet been taken to dismantle them.

Sports hall at Otaniemi

About two years ago the students of the Institute of Technology started to build dwelling houses for their own use at Otaniemi near Helsinki, and it was decided that an earth-floored sports hall should also be built which might serve as a training centre throughout the year. In view of the training facilities needed for the Olympic Games, construction work was pushed ahead so that the hall — the first of its kind in Finland — could be put into use at the beginning of February 1952.

To keep down costs, the hall is small in area (47 × 89 meters) with only a 150 meter race track, jumping and throwing points, and a stand for 1,500 spectators. The framework consists of prefabricated nailed and glued board frames set 4 meters apart. The structure of these frames is that of the Swedish patented HB-beam (Fig. 3) consisting of the " web " E and flanges P. The former has two courses of 7.8 in. (2.2 cm.) planed boards, each set at 45 degrees to the axis of the beam, but in opposite directions. The flanges are composed of three planed boards glued together with special joints and nailed to the " web ". The frames, which have a span of 47 cm. and a " free " depth of 12 cm. at the center, are joined to the concrete foundation. On these frames are 4 × 6 in. (10 × 15 cm.) joists (62 cm. center to center); 2.2 × 3.0 cm. ribs (5 cm. center to center); a 7.5 cm. thick glass wool mat (for thermal insulation); a $^7/_8$ × 5 in. (2.2 × 13 cm.) diagonal sheathing as reinforcement against wind stresses; a 7.5 cm. high opening for ventilation; $^7/_8$ in. (2.2 cm.) tongue and groove sheathing, and double bitumen felt for water insulation.

In order to support these great static stresses, the frame dimensions needed were considerable; the depth of beam at the corner of the frame is 3.36 m., the effective area of cross-section being equal to 1,150 sq. cm. (Fig. 4). The frames were made at three factories producing prefabricated houses, in different parts of Finland, and were transported to Helsinki. On arrival at the building site they were assembled in a horizontal position

Figure 4. Showing the depth of beam at the corner of the frame.

one by one and nailed with pneumatic hammers. They were then raised vertically (Fig. 5) and transported to their final position by truck along three rails parallel to the hall.

As early as February 1952 sportsmen were able to start training in the hall, and some weeks before the beginning of the Games the student quarters began to be filled with foreign athletes who used the hall and adjoining buildings for eating, training and recreational purposes.

Figure 5. The frames seen in a vertical position.

Commodity Reports

Fuelwood

After food, the basic requirements of man are fuel and shelter, and these in some cases even claim equality with food.

For the vast majority of the population of the South-east Asian region — which is little less than half the world's population — fuel is tantamount to fuelwood, including charcoal. Fuel which is needed for cooking and in parts of the region for heating, with few exceptions means wood. A good many of the industries in the region are operated on wood; so are several railways and many river and coastal craft. They are, therefore, bound up with the availability and economy of fuelwood compared with other fuels.

Alternatives to wood are coal (and lignite), oil and electricity, as well as fuels of agricultural origin. Average figures for 1950 and 1951 coal production give the following results (in million tons): Japan 40.8; China 37.5; India 33.0; Indonesia 0.8; Vietnam 0.5; Pakistan 0.5; Malaya 0.4; South Korea 0.3; the Philippines 0.2. There is no production in Burma, Cambodia, Ceylon, East Pakistan, North Borneo, Sarawak and Thailand. As for oil, Brunei and Indonesia have a fairly large production, while output in the few other producing countries is relatively unimportant. Nearly all the region's coal and oil production is consumed in certain urban areas and certain industries and railways within the region. As regards hydro-electric power, the installed capacity is about 6.6 million kw. in Japan, and 0.6 million kw. each in India and China, used locally for light and power.

Combustible agricultural residues such as straw or cowdung are being used in some areas, but they are inferior to fuelwood and their use merely indicates non-availability, or prohibitive cost of wood. Fuelwood will remain the chief source of fuel in rural areas and will also cover part of the urban consumption (as charcoal). Also, in certain countries of the region certain sectors of industry as well as railways will probably continue to be dependent on wood. There are areas in the region so badly off for any kind of fuel that consumers are forced to import fuelwood over long distances irrespective of cost. Imports of fuelwood from Borneo to Hongkong or even to Korea must necessarily be expensive. Singapore imports fuelwood and charcoal from Malaya, but also a considerable amount from Indonesia (Sumatra). Transport and trade in fuelwood and charcoal within these countries represent an important activity employing considerable labour.

Such is the vital importance of wood as fuel in the region that it is indeed a basic requirement.

Research in progress

There are thousands of tree species in the region, and research is going on in several places to determine and analyze the properties of the more important species. With regard to combustion properties, research confirms the results established in other parts of the world, namely that the calorific value per unit weight of moisture-free wood is fairly constant, but is normally somewhat increased by a resin or oil content. Extremely light woods such as *Trema orientalis* with a specific gravity of 0.25 show the same calorific value per kg. as woods of three times that specific gravity, e. g. *Bruguiera parviflora* or *Rhizophora spiculata* which have specific gravities of 0.81 and 0.84 respectively. But the heavier woods of course require less storage space and less frequent replenishment of the combustion chamber, and are therefore normally preferred. This is particularly true where space is limited, as in locomotives and boats.

The theoretical calorific value of oven-dry hardwoods may be taken as 4700 cal./kg. with less than 10 percent deviation. Since green wood can sometimes hold as much as 200 percent moisture (moisture-free basis), the moisture content of the fuelwood becomes a matter of great importance, first because of the direct loss in calorific value by heating and evaporation (see Table 1), and second because of the inconvenience of a high moisture content, such as reduced inflammability, smoke and condensation.

TABLE 1. — AVAILABLE HEAT VALUE FROM WOOD OF VARYING MOISTURE CONTENT (oven-dry basis)

	(percentages)						
Moisture content	0	10	20	30	40	50	100
Heat value	100.0	89.5	80.5	73.0	66.5	61.0	41.5

Only a pitiably small percentage of the theoretical heat value is actually being utilized in most of the furnaces throughout the region.

Statistics

The very heterogeneity of the countries of this region make statistics particularly misleading where forestry is concerned.

Table 2 is based on official figures for population, forest area, and fuelwood consumption.

The figures for population density do not give any indication of the distribution; it is sufficient to recall that the figure for Java is nearly 400 and for the rest of Indonesia 16, and similar uneven distribution is found in many parts of the region. Further, forests are often concentrated in certain parts of a country and fuelwood economy cannot bear much transportation cost.

The figures for fuelwood consumption are entirely unreliable and it is obvious that in most cases the recorded figures cover only a small fraction of total consumption. There are several reasons for this: probably the greater part of total fuelwood consump-

tion in the region does not involve monetary transactions, the wood being cut by the consumer. When forest is within easy range most of the rural population take care of their own needs, with or without legal right. Much fire wood stems from wood lots or tree-groups on the homestead land, and from rubber plantations where periodic removal of the trees is necessary. The practice of shifting cultivation provides firewood for the tribal population. Even when firewood is a priced commodity and is actually transported and sold, only part of it will be registered or taxed. Among recommendations for improving forestry statistics, suitable sampling methods should certainly be proposed in order to assess the rural consumption of fuelwood (and fencing and construction timber) most of which now entirely escapes recording in the majority of countries in the region.

Local forestry officials estimate that consumption of fuelwood (including wood for charcoal) in countries like Burma, Thailand, Malaya, Cambodia, Laos, Indonesia, British Borneo or the Philippines is more likely to be from 300 to 500 kg. per head than the figures given in Table 2. The figures for India and Pakistan may be somewhat nearer actual consumption.

Distribution of total fuelwood consumption within the various consumer groups naturally varies very considerably from place to place, influenced as it must be by density of population, degree of industrialization, availability of other fuels, transport facilities and costs. As an example, a recent calculation shows that the fuelwood consumption in Burma in 1951 was distributed as follows: household consumption 88 percent, industries 10 percent and transportation 2 percent.

It is reasonable to assume that a similar ratio exists in countries such as Indonesia, Thailand and Vietnam while the proportion may be very different in other parts of the region.

The present situation

There are areas in the region where all fuelwood requirements are fully met and will continue to be met for some time. This does not only apply to forest communities proper where dependence on the forest often goes as far as to include food and fodder, but also to agricultural tracts where forest is still abundant within easy range. Such areas of abundant supply are found, for example, in many parts of Burma, Indochina, Indonesia and Thailand. But even in these areas the forest is receding from the consumption centres as a result of fuelwood being cut where it is nearest at hand, easiest to carry home; the villager is therefore finding the distance to his source of supply increasing, as no special efforts are made to restock the areas cut over.

The cases where there is a more or less pronounced scarcity of fuelwood (or charcoal) are more frequent and affect a far greater number of people; it is either in short supply or the price is so high that the common man has to reduce his consumption below a reasonable level, or resort to inferior fuels. It is well known that dried cowdung constitutes the kitchen fuel for millions in India, and that in many parts of China fuelwood in tiny bundles is weighed on hand scales. Here the use of fuelwood is a luxury which only few can afford.

The countries deficient in forest resources are China, India and Pakistan, (see Table 2). Timber can bear a higher or lower transportation cost, according to its value, but fuelwood can only stand a very modest transportation cost, since it otherwise tends to become a luxury article. Therefore, when considering fuelwood supply a local view must be taken. Areas of abundance and areas of scarcity may be found at a short distance from each other. Among the Indian States fuelwood production ranges from over 65 kg. down to 1.36 kg. per head, but within the more important States an even wider range will be found.

TABLE 2. — POPULATION, FOREST AREA, AND FUELWOOD CONSUMPTION IN COUNTRIES OF THE SOUTHEAST ASIAN REGION.

Country	Population (millions)	Population per sq. km.	Forest percentage (all forests)	Forest area per head (ha)	Accessible or productive forest area per head (ha) (approx.)	Annual fuelwood consumption per head (kg.)
Pakistan	74	79	5	0.03	0.03	9
India	346	109	18	0.2	0.2	14
Ceylon	7	111	55	0.5	0.2	14
Burma	18	30	58	1.9	1.5	140
Thailand	18	35	63	1.8	1.8	60
Malaya	5	38	77	2.0	1.2	90
Cambodia	4	21	66	3.1	0.7	60
Vietnam	22	67	42	0.6		7
Laos	1.2	5	55	10.8		35
Indonesia	72	48	63	1.3	0.9	10
Brit. Borneo	1.0	5	86	17.2	5.0	170
Philippines	20	66	59	0.9	0.7	3
Japan	82	215	59	0.3	0.3	180
Korea (south)	20	126	40	0.3	0.1	30
China (all)	463	48	9	0.2	0.1	?

Phases in fuelwood exploitation by villagers in Nepal: left, felling and billeting with the axe; right, splitting with the axe and bundling.

In general, the scarcity is felt more heavily in urban than in rural areas. During past decades the forest has receded from towns and cities, as well as from the main lines of communication — rivers, roads, and railways — thus aggravating the supply problem. The situation has deteriorated still further through wartime overcutting, the heavy migration to urban centres after the war and the formation of a number of new, independent States. Several cities and towns have doubled their population compared with prewar, one of the main reasons being the state of unrest prevalent in some rural areas. To-day, the fuel supply for some cities has to be transported a hundred kilometers or even considerably more, and the price has risen accordingly. A policeman or an office clerk in Bangkok may easily have to spend 10 percent or more of his earnings on charcoal to cook the family's meals; fuel is therefore one of the heavy items on his budget.

What has been said above of the availability and price of fuelwood for domestic use applies in principle equally to fuelwood supplies for industry and railways. There is the difference, however, that in many cases they are allocated certain forest areas and make their own arrangements for exploitation, transportation and delivery through local contractors. These contractors possess as a rule only inferior transport equipment and have therefore overworked the forests closest to the delivery points, leaving scattered areas in which working is now uneconomical.

In twelve of the countries listed in Table 2 more than 40 percent of the land is forested. On the face of it, this should be sufficient to cover all requirements for forest produce leaving something for export. However, very considerable areas classified as forest are in poor condition both as regards quality and quantity of growing stock, and other areas are more or less inaccessible. The bulk of the forests are situated far from the cities and the heavily populated agricultural areas, and availability of fuelwood within a country does not mean economic availability for the majority of the consumers. Nevertheless, the solution of local fuelwood supply problems in these countries, even if sometimes difficult and expensive, does not imply considerations of such a serious, or even vital, nature as is the case in large parts of China, India and Pakistan. The countries listed in Table 2 have 1,150 million inhabitants. We would venture the estimate that for about half of this number — one-quarter of the world's population — the fuelwood supply represents a serious or critical problem.

Remedial measures

Naturally, some measures have been taken and attempts made in many places during the past decades to improve the situation. Since World War II, no less than 10 of the 15 countries listed in Table 2 have become independent States. Full responsibility for improvement now rests with them; at the same time they have lost a considerable number of professional staff in nearly every field of activity and are faced with political and economic problems more complex than before the war. In forestry, however, professional circles are well aware of the situation and are furthermore capable of initiating broad action, if only they are given the necessary authority by their governments, as well as appropriate funds. Technical advice from outside may in many cases assist planning and so may equipment and training facilities provided by outside agencies, but thorough and lasting improvements will be obtained only if well-conceived and continued efforts are made by the countries themselves.

Where forest resources are adequate, improved logging and transportation methods and equipment alone may solve the problem. But continuous management and planned supply are urgently needed if lasting improvements over large areas are to be achieved. Where fuelwood is carried by rail to urban centers, transport costs would be reduced considerably by conversion of the wood into charcoal before transportation. This points to the need for modernization of carbonization methods; recovery of some of the by-products in an economical way would also help to lower the price of charcoal.

Creation of fuelwood plantations should play an important role in the scheme. Many non-urban industrial plants might cover their fuel requirements from their own plantations, and townships and railways could alleviate their supply situation considerably by

planting up wasteland areas in their vicinity with species suitable for short-rotation management. For example, some tea plantations in Java have their own fuel plantations; near Manila, there is a fuel plantation delivering fuelwood and charcoal for ordinary home consumption and fuelwood for bakeries; even in Sarawak, the richest in forest land (89 percent), a small fuelwood plantation supplies fuel to bakeries.

While the creation of fuelwood plantations in most parts of China, India and Pakistan is a matter of obvious necessity and vital urgency, it is certainly justified also in other countries because of the uneven distribution of the population. Everywhere the population is heavily concentrated in the river plains and coastal lowlands where practically no forest is left. The inhabitants of these densely populated agricultural areas often find it difficult and expensive to meet their needs for fuel, fencing material and small timber. A very small woodlot or plantation on each farm would go a long way towards meeting these requirements. In other cases, the availability of marginal land would indicate village or community plantations. Plantations on irrigated areas are by no means out of the question, as has been proved in Pakistan, and large-scale techniques such as aerial sowing are being planned for areas in West Pakistan.

The price level of firewood in the densely populated areas will in most cases make firewood plantations profitable. Reports show that such plantations already pay high dividends. Except for individual farm plantations, subsidies for their establishment might in many cases be possible on a credit basis.

In addition to increased production, economy in consumption should be given careful consideration. Suitable stacking for drying-out firewood as far as practicable during the dry season of the year, and storage under cover might well reduce consumption by several percent, as would adjustment of the size of the pieces or billets to individual furnaces. Reports from Cambodian railways show economy by reducing the 80 cm billets formerly used to 40 cm lengths. In principle, the optimum length of billets should be studied for each type of furnace. Open-fire furnaces may utilize only 5 percent of the calorific value, and most ovens may not reach more than 25 percent. Introduction of cheap, efficient ovens, and supply of cheap devices for making existing ovens more effective, are believed to represent a wide field for improvement and economy.

Except in the few places in the region where superior fuels are available for cooking and heating, substitutes for fuelwood cannot generally be considered a practical remedy. It is possible that the cowdung now being burnt might relieve Indian provinces of famine threats if it could be used instead on the fields.

FAO contribution

The Forestry and Timber Utilization Conference for Asia and the Pacific convened by FAO at Mysore 1949, made the following statement: "After soil conservation, the second major problem for many countries is the urgent need for fuelwood and charcoal, and cheap supplies of sawn timber, poles and other building materials. The Conference is agreed that in the deficit countries, immediate steps must be taken to increase the availability of such supplies by all possible means, including the establishment of village fuelwood reserves of quick-growing species and the encouragement of small holders to set aside even a small portion of their land for the growing of fuelwood, poles and timber. The urgency of the problem must continually be brought to the notice of governments, because failure to find a solution may have serious repercussions on social life and on agriculture".

This statement was further elaborated in Recommendation IX on domestic needs.

FAO's Forestry Division has on its program several projects which bear on fuelwood problems. Most directly concerned is a joint FAO/ECAFE study on fuelwood for locomotives which is now completed. Although this study deals with a field of consumption which, from a regional point of view, absorbs only a very minor percentage of total fuelwood production, it is an aspect of interest to railway technicians, to certain sides of the national economy and to the general fuelwood problem.

A two months' study tour in Australia on *Eucalyptus* was carried out by many senior forestry officials from several countries during September-October 1952. While fuelwood supply may not be the main object of introducing *Eucalyptus* species into several countries, it is of importance in this respect in some parts of the region. A critical review of irrigated plantations in the Punjab says that "for fuel production there is nothing to beat *Eucalyptus*...", but good results depend on choice of species and methods of sowing and planting.

A six months' training course on mechanical logging opened in the Philippines on 1 October 1952 with an attendance of forty trainees from eleven Far Eastern countries. Here emphasis is chiefly on the timber side, but it should not be overlooked that both availability and price of fuelwood in many consumption

Nepalese villagers carrying home fuelwood.

centres in the region can be appreciably influenced by improvements in logging and transportation methods.

A number of specialists in various fields of forestry on assignments to Far Eastern countries under FAO's Expanded Technical Assistance Program have had, or will have, to deal with fuelwood problems from different angles. Be it general forest policy, afforestation, management, or logging, at some stage questions relating to fuelwood supply will present themselves and demand solution.

The FAO Regional Office in Bangkok is endeavoring to give technical service in matters pertaining to fuelwood — such as supply or exchange of seeds and cuttings; assistance or initiation of research on fuelwood, charcoal and distillation and collection of information on fuelwood plantations.

Hundreds of millions of people in Southeast Asia are affected by fuel shortage. FAO will do its best to assist the national efforts that are being made and firmly believes that lasting results will be achieved.

Railway Sleepers

Compared with regions of higher economic and industrial development, Southeast Asia is heavily deficient in railroads measured by population or area. As the same applies to other means of inland transport, this increases the importance of the existing railroads and their maintenance and extension. In fact, the limitations of the present transport systems represent a bottleneck in the further economic development of the region. This situation is summarized in the table on page 31.

Sleepers

Railroads depend on sleepers (crossties, switch ties, bridge ties) for supporting the rails, transmitting the load on to the roadbed and ensuring the exact gauge. The world total of sleepers in use may be approximately 3,000 millions, of which 95 percent are made of wood. Alternative materials are mainly steel, cast iron and concrete. Steel or iron sleepers are in use to a considerable extent in some countries, for example, Germany, Switzerland, Turkey, India, Pakistan and Indochinese countries, while concrete sleepers are most widely used in Italy. It is reported that several thousand patents have been granted for substitutes for the wood sleeper, but none has offered a serious challenge when viewed on a world basis. For individual countries, however, this picture may be different, and this is so for some countries in the Southeast Asian region. Nearly all the sleepers used in Vietnam and Cambodia are steel or iron (Laos has no railroads), and so are 45 percent of those in India and Pakistan. Sleepers in use in the countries listed in the table (minus China) number approximately 200 million made of wood and some 50 million of steel or iron. The percentage of wood sleepers in the region is thus considerably below the world figure. It is interesting to note that in the U.S.A., where weight and speed of locomotives are much in excess of those in the Far East, practically all (99.98 percent) of the sleepers are of wood, whereas some countries in this region with little iron and steel of their own use quite a considerable amount of iron and steel sleepers, many of which are imported.

The superiority of wood as material for sleepers is due, in short, to its resilience, strength, economy, availability, electrical resistance, non-corrosive qualities, sound-absorbing ability, spike-holding capacity and non-electrolytic properties. Its disadvantages are: liability to attack by fungi and insects, and to checking and splitting, combustibility, mechanical wear through actual abrasion and crushing of fibers, and irregular dimensions and surfaces, particularly of hewn sleepers.

Wood sleepers are hewn or sawn, on one, two, or four sides, on one side being the least common and on four sides the most common. Hewn sleepers are often more straight-grained and generally have more sapwood, an advantage for preservation. Sawn sleepers are more uniform in size, which means a saving in transportation and handling, and economy and accuracy in preservation; also rail seats are more easily adzed and bored. In addition, sawing allows for utilization of a considerable percentage of the roundwood which by hewing would be wasted as chips. However, a more decisive factor, at least in these regions, is that forest labor has become much more expensive and is not so easily available as prewar, with the result that hewn sleepers are losing ground. In 1937-38, the production of sleepers in Western Australia was 56 percent hewn and 44 percent sawn. From then on the proportion of hewn sleepers declined continuously, and for 1950/51 the figures are 0.1 percent hewn and 99.9 percent sawn. "The hewer has now practically disappeared from the forests of Western Australia, and there appears to be little possibility of sleeper hewing again being of any consequence in that State". To a more or less pronounced extent, a similar development can be observed in other parts of these regions.

Dimensions of sleepers vary to a considerable extent from country to country according to the various traditional specifications. As an example, broad gauge sleepers in India are 9ft. x 10in. x 5in., meter gauge sleepers are 6ft. x 8in x 4½in., and narrow gauge sleepers are 5ft. x 7in. x 4½in. For practical purposes, this gives 10, 20, and 30 sleepers to $1m^3$ (s) respectively (narrow gauge is not much in use). For conversion, broad and normal gauge sleepers may be taken at a volume of $0.1m^3$ (s) which would correspond to a log volume of between 0.15 and 0.20 m^3 depending on size and quality of logs and on the method of conversion (sawing or hewing, on 4 or 2 sides). In the case of half round sleepers (see below) there is practically no waste in conversion.

Requirements

The number of sleepers per km. track varies in different countries and for different types of railroads between 1,200 and 2,100, and is taken to be 1,500 for

the purpose of the estimate in column 4 of Table 1. The present annual requirements as given in column 5 are partly based on various reports and partly estimated. The greater part of the requirements covers annual renewal of worn-out sleepers, and the balance the construction of new lines, repair of war damage etc. The annual renewal is determined by the service life of the sleepers which again depends, apart from preservative treatment, on the species used and on factors such as load and frequency of traffic, climate, attacks by insects or fungi, etc. Naturally durable species like teak, *Shorea robusta*, other durable *Shorea* species, or *Xylia* and others are the main species used in India and neighboring countries. *Shorea robusta* accounts for about 50 percent of all wood sleepers in India and has a service life of 12-16 years: teak gives 25 years; *Mesua* and *Hopea*, species used in South India, only 6-7 years. Australia uses various *Eucalyptus* species of high durability, from 15 upwards to 50 years service (iron-barks, boxes, river red gum, jarrah etc.). Average service life is between 7 and 25 years, which would mean annual renewal of from 4 to 15 percent of the sleepers in the tracks.

Several countries are extending their railway lines. India finished 375 km. in 1950, and Pakistan 102 km; Thailand plans to build 100 km. annually from 1952 onwards, and the Philippines, China and other countries have been carrying out rehabilitation work. This raises the annual requirements for such countries quite considerably.

Total annual requirements for the countries listed in the table (minus China) amount to 1.2 million m^3 or, in terms of logs, about 2.2 million m^3, 6 percent of the total log production of these countries. Supplying this volume might not seem to present heavy difficulties. However such difficulties do arise in countries possessing nearly 90 percent of the length of railway track in the region.

Each country has its own specifications for sleepers, in official standards (e.g. India, Japan), in grading rules (e. g. Malaya, Philippines), or simply in the conditions of delivery. They set forth the requirements with regard to species, treatment, sizes and size tolerances, sapwood proportion, and all the various types of so-called defects and their tolerances. Sleepers which do not fully meet the specifications are rejected. It is questionable whether most of these specifications are not too exacting and contain stipulations that needlessly impede increased supply, and it is believed in forestry circles that this is the case. The Forestry Conference for Asia and the Pacific convened by FAO at Mysore in 1949 recommended "that... a revision of specifications be undertaken to ensure closer utilization on a more realistic basis; and that, in particular, there be some relaxation of the very exacting railway sleeper specifications existing in some importing countries of the region."

TABLE 1. — RAILWAY TRACKS AND USE OF WOOD SLEEPERS IN COUNTRIES OF THE REGION.

(Figures are partly estimates and are for provisional orientation only)

Country	Length of track in km.	Gauge	Wood Sleepers: Number in use (million units)	Annual requirement 1000 m^3 (s)	Production 1000 m^3 (s)	Import (+) or Export (—) 1000 m^3 (s)
Pakistan	11 660	broad, meter and narrow	9	60	8	?
India	62 113	broad, meter and narrow	50	340	284	—
Ceylon	1 442	broad	1	12	3	+ 9
Burma	2 738	meter	4	25	?	—
Thailand	3 270	meter	5	36	36	—
Indochina	3 007	meter	0	0	0	—
Malaya	1 438	meter	2	15	15	—
Indonesia	7 549	3ft. 6in., meter	11	45	45	—
Br. Borneo	187	meter	0.3	2	2	—
Philippines	1 046	3ft. 6in.	1.5	15	?	?
China	47 580	normal, 3ft. 6in., meter	?	?	?	?
Korea	3 380	normal	5	50	20	?
Japan	23 013	3ft. 6in.	35	400	255	— 20
Australia	48 071	3ft. 6in., normal, 5ft. 3in.	70	240	191	— 37
New Zealand	5 680	3ft. 6in.	9	30	0	+ 31

Note: Figures for length of track and information on gauges by ECAFE, Railway Section. Broad gauge is 5 ft. 6 in. (in Australia, 5 ft. 3 in.), normal gauge is 4 ft. 8½ in. and narrow gauge 2 ft. 6 in. (to a small extent also 2 ft.). Pakistan has 71 percent broad, 20 percent meter and 9 percent narrow gauge. In India, 47 percent of the track is broad, 45 percent meter, and 8 percent narrow gauge. In Ceylon, 10 percent of the track is narrow gauge. In Indonesia, Deli Railways in Sumatra have meter gauge, otherwise it is 3 ft. 6 in. China has 88 percent normal, and 12 percent 3 ft. 6 in. and meter gauge. Australia has 47 percent 3 ft. 6 in. gauge, 28 percent normal, and 25 percent 5 ft. 3 in. gauge. For sleeper dimensions, see text.

Figures for wood sleepers in use are quoted from a report in the case of Australia, and applied to New Zealand; otherwise this is taken to be 1,500 pieces per km. track (see text).

Sleeper production, and exports or imports, are entered as averages over 4 years (1947-50) for Ceylon, Malaya, Japan and Australia; as averages over 3 of the years (1947-50) for Borneo and Korea; as averages over 1949 and 1950 for Thailand; and as 1950 production for Pakistan and Indonesia. Production in Indochina and New Zealand was less than 500 m^3 (s) in 1950. New Zealand imports are from Australia; Ceylon imports were from North America and have now stopped. The figures for India and Ceylon are based on separate information while the others are taken from the FAO questionnaires. Question marks indicate that no information is available.

The supply position

Practically all railways in the region are state-owned or at least state-controlled; this means that there is a monopoly in the purchase of sleepers. The depletion in the most easily accessible areas of preferred sizes of naturally durable species for sleepers and other purposes has brought about a lowering of the quality and an increase in the price of timber. The present strict sleeper specifications are responsible for the fact that very often the "cream" of the timber, the best grades and also the most durable species, are required for sleepers (in Northern Europe, beech sleepers are cut from the lowest-grade logs, and beech is a non-durable species). The classification in Vietnam places sleepers among the uses for 7 species of "first category" timbers, 1 species of the "second category", and none of the "third category", a classification that is characteristic of the region. The result is that it is increasingly difficult to meet demands. The table shows that annual requirements exceed production in Pakistan, India, Ceylon, Korea, Japan, Australia and New Zealand. Burma, Thailand, Malaya, Indonesia, N. Borneo and the Philippines can meet their requirements, but they represent only little more than 10 percent of the railway network. When wood chunks with tie bars are used in parts of India and Pakistan, this merely indicates scarcity of sleepers. On the other hand, the use of half-round sleepers of teak, and to a lesser extent *Shorea robusta* as used for many years by certain railways in India, would seem to be a much more positive proposition and might be a highly recommendable system in areas where thinnings of 25-40 cm. diameter trees are available (e. g. Java teak).

In Australia, normal requirements and deferred maintenance from the war years amount to 240,000 m^3, while in 1950 production was only 178,000 m^3: this situation is considered rather serious. Australia traditionally exports hardwood sleepers to New Zealand (35,000 and 22,000 m^3 in 1949 and 1950 respectively) in return for sawn softwood. As New Zealand now finds it more difficult to obtain sufficient supplies, it is hoped that *Pinus radiata*, which is plentiful in New Zealand, will remedy the situation; experiments with *P. radiata* sleepers in South Australia have been very satisfactory.

Japan reports an annual consumption of 2.9 million koku (round) or more than 400,000 m^3 (s), while production appears to reach only 65 percent of this figure (production has decreased from 442,000 m^3 (s) in 1947 to 121,000 m^3 (s) in 1950). A number of measures are being taken and a retrenchment program set up, in order to balance the figures for sleepers as well as all other timber products.

The figure for India's annual requirements given in Table 1 presupposes that tracks on steel or iron sleepers will be maintained with the same material, but in the interests of steel economy it is desirable to begin conversion to wood; this would raise requirements correspondingly. The Forest Research Institute has issued a list comprising 36 species of secondary timbers suitable for sleepers. Problems of sizes, specifications and the waste in conversion are being considered. The current scarcity has been created by unrestricted exploitation of the best sleeper-size trees in connection with the strict specifications, and prices are now high. The average price in 1950 for first class sleepers (*Shorea robusta*) was 18 Rupees for broad gauge and 8.5 Rs. for meter gauge sleepers.

Most important among the ways of meeting the sleeper supply is the prolongation of the service life of sleepers by preservative treatment. The history, technique and effect of sleeper impregnation is known the world over; sleepers were in many cases the reason for the erection of timber impregnation plants. In this region experience has shown that the technique developed in Europe could not simply be taken over but would require considerable adjustment to suit tropical species many of which are refractory to impregnation, and require high pressure treatment (many *Eucalyptus* species among others). So far, only a few pressure impregnation plants are in operation in the region (apart from Japan), but many are in the planning stage and will enable many species of lower durability to be used for sleepers.

Alleviation of the supply situation cannot be met through imports from overseas because of currency difficulties and the high cost of transportation. During the immediate postwar years, the U.S.A. and Canada exported considerable quantities to China, and smaller quantities to Ceylon, the Philippines and Korea, but this must be considered more as a relief measure than as regular trade. However, these difficulties do not apply to such an extent in intra-regional trade whose prospects of future development are brighter, especially in treated sleepers.

A complete standardization of the specifications would be of high importance for the economic use and improved supply of sleepers. Present requirements for dimensions and quality are the traditional specifications which were established 60 to 80 years ago when forests were abundant and there was no timber supply problem. It is believed that a scientific determination of dimensions as well as of defect tolerances would improve economy and increase supply from domestic forests or from those of neighboring countries. Sleeper standards for the region or for geographical groups of countries within the region would considerably facilitate intra-regional sleeper trade which is at present hardly existent (except between Australia and New Zealand).

This standardization would constitute a useful starting point of attack, and the Asia-Pacific Forestry Commission at its recent meeting in Singapore, felt that, if there were no standardization and no lowering of specifications, supply was going to be difficult in the future, even though exports were to become available from new areas such as New Guinea. (It was considered desirable that FAO and the United Nations Economic Commission for Asia and the Far East together should endeavor to secure a revision of specifications and a degree of standardization in the region).

The Commission recommended wider use of impregnated non-durable hardwoods which were at present in little demand. Many of these timbers could be safely shipped untreated, to avoid the extra costs of dirty cargoes, and be impregnated in the user countries.

The Work of FAO

The Sixth International Grassland Congress

Grasslands account for more than half of the earth's land surface and are one of its greatest assets. In every part of the world scientists, administrators and producers are working to improve them and have had experiences which may benefit others.

The bringing together of more than 1,500 participants from 50 countries at the Sixth International Grassland Congress made possible the free interchange of ideas and offered an unusual opportunity for mutual understanding. Emphasis was placed on greater and more economical production of forage, meat, wool, hides and other animal products together with other aspects of grassland agriculture. The application of such information to particular growth conditions in different parts of the world can have far-reaching results in raising and maintaining the living standards of people of all nations.

Under the sponsorship of the United States Government and FAO, the Sixth Congress was held at the Pennsylvania State College 17-23 August 1952. It was the first to be held in the United States, and brought together the largest representative worldwide group of grassland scientists ever assembled. Over 1200 attended from the United States and more than 300 from other countries.

Philip V. Cardon, U. S. Department of Agriculture, was elected President. Vice Presidents were Claudio A. Volio, Minister of Agriculture and Industries, Costa Rica, and J. Griffiths Davies, Commonwealth Scientific and Industrial Research Organization, Australia. Will M. Myers, University of Minnesota, was named Secretary General. Deputy Secretaries General were Clark L. Willard, Department of State, Herbert R. Albrecht, the Pennsylvania State College, and W. R. Chapline, Chief, Division of Range Research, Forest Service, U. S. Department of Agriculture.

Welcoming addresses were given by Secretary of Agriculture Charles F. Brannan, Governor John F. Fine of Pennsylvania, and President Milton S. Eisenhower of the Pennsylvania State College. Greetings from the Director-General of FAO were brought by Gove Hambidge, North American Regional Representative. Dr. Cardon, in his presidential address, spoke on "Our Concept of Grassland Agriculture".

Congress Resolutions — A resolution presented by J. Banerji, Deputy Inspector General of Forests, India, was unanimously approved by the Congress. It recognized the importance of grassland agriculture, the advisability of scientific management, and that improvident management has resulted in loss. It urged that each country should formulate a national grassland policy consistent with its climatic, biotic, social and economic situation. As a part of that policy it suggested research, surveys and action programs for applying improved practices. It also suggested that FAO consider the collection and dissemination of appropriate available data about grasslands in different countries and the possibility of developing a system of statistical enumeration for classification and output of grazing lands for use on an international basis.

Sectional Meetings — Sectional meetings were devoted to presentation of papers and informal discussions of the subjects presented. These discussions often proved of great value in developing highlights of problems, results and procedures. Numerous papers discussed measures for achieving larger yields from the soil through such methods as plant breeding and production of improved seed, appropriate pasture management, application of fertilizers, soil and water conservation, mechanization and other practices. Other sessions covered problems of harvesting and preservation of forage and its use in the feeding of livestock. Still others considered grassland ecology and physiology and techniques in grassland research.

Major grassland developments have occurred mainly in the temperate zones of the world, although in recent years important advancements have been made in tropical areas. One particular section, convened by S. H. Work, North American Regional Office, FAO, was devoted to improvement and management of tropical grasslands.

In addition to the section on improvement and management of range lands, range problems, relations, results, research techniques and appropriate machinery were also considered in several other sections in which active interest was shown. Range land management was covered from the view-point of developments in South Africa, Canada, Pakistan, the high Andes and the tropics.

Forest grazing in the southeastern United States and in the Philippines was also discussed in the Tropical Grasslands Section. The research underlying the management of arid and semi-arid range lands throughout the world was outlined. The need for co-ordination between the hill country range lands of New Zealand and the more productive cultivated pastures brought out the importance of integration between range and other agricultural production.

The second session on range land was devoted to reseeding problems, and consisted chiefly of two panels concerned with essentials underlying selection of species for range reseeding and methods and procedures most likely to ensure success. The concluding range session included a symposium on shrub encroachment and noxious plants and their control.

Demonstrations and Field Trips — The exhibits and demonstrations at the Congress emphasized and magnified the changing conditions in a modern world. They brought together the greatest array of grassland equipment, machinery and other related developments ever assembled. The 15,000 farmers and Congress participants who viewed the field day demonstrations were enthusiastic about the possibility of utilizing modern machinery for the efficient clearing of land, control of brush, establishment and renovation of pastures, and the harvesting and preservation of forage. The opportunity for sprinkler irrigation even in semi-humid and humid areas to keep production at a high level during dry periods, and of the use of fertilizers and other chemicals for high forage production, controlling insects, weeds and other pests and other industrial developments, were all effectively demonstrated. Much interest was also shown in the use of airplanes for spraying and dusting.

Four 2-week post-Congress tours were conducted simultaneously in major grassland areas of the country: the Northeast, the Midwest, the South and the West. On these tours participants were shown field experiments, practical application of grassland agriculture on farms, and resultant meat, wool, milk, and other livestock production and many industrial enterprises related to grassland agriculture.

The proceedings of the Congress, which will include all papers presented and other Congress developments, will be published in a 2-volume edition of approximately 800 pages each.

The request of New Zealand to be host to the Seventh Congress was unanimously approved.

The Sixth Congress was conducted for the exchange of ideas and experiences among scientists, technicians, and practical operators rather than for the development of agreements relating to governmental policies. This forum provided a fruitful approach and the Congress undoubtedly proved more productive by virtue of this limitation. Continuing collaboration of participants and others directly interested in grassland agriculture has an added timeliness in view of technical assistance programs for economic development now under way in many countries, with the active support of FAO.

European Commission on Forestry

The European Commission on Forestry held its fifth session at the Palais des Nations, Geneva, from 14 to 25 October 1952.

During the session, several joint meetings were held with the Timber Committee of the Economic Commission for Europe.

The following member countries of the Commission were represented at the session: Austria, Belgium, Denmark, Western Germany, Finland, France, Ireland, Italy, Netherlands, Norway, Portugal, Sweden, Switzerland, Turkey, United Kingdom and Yugoslavia. Observers attended from the United States and Canada as well as from the following international organizations: the International Labour Office, the Organization for European Economic Co-operation, the International Union of Forest Research Organizations (IUFRO) and the International Poplar Commission.

The session was opened by O. J. Sangar of the United Kingdom, Chairman of the Commission, in the presence of Marcel Leloup, Director, Forestry Division, who represented the Director-General of FAO.

In the absence of Professor Saari of Finland, Vice-Chairman of the Commission, who was taking part in an FAO mission to Paraguay, N. Osara, head of the Finnish delegation, was elected Vice-Chairman and appointed Rapporteur for the Session.

Timber Trends Study — The Commission met in joint session with the Timber Committee of the Economic Commission for Europe to consider the first draft of a Study of Trends in European Timber Consumption, Production and Trade.

After hearing the opening statements by Gunnar Myrdal, Executive Secretary of ECE, Mr. Leloup and E. Glesinger, Deputy-Director of the Forestry Division, in charge of the Study, the Joint Meeting elected O. J. Sangar, as its Chairman, and F. du Vignaux, Chairman of the ECE Timber Committee, as its Vice-Chairman and Rapporteur.

Delegations were unanimous in congratulating the Secretariats on the work accomplished. Commended for its structure and scope, and for the quality of its documentation, the Study was regarded as a document of the highest value, which could undoubtedly be of great assistance in the formulation of medium-term policies for timber production, consumption and trade and related investment programs (the year 1960 being taken as typifying a medium-term).

Nevertheless, in view of the complexity of the problems raised in the Study and the inadequate time available for detailed consideration in its entirety, certain delegates questioned the advisability of publishing the document at the present time.

Since the Secretariat did not wish to delay publication, however, the Joint Meeting agreed that the document could be published *on the sole responsibility of the Secretariats*, providing this was stressed in the published study and given prominence in any statements to the Press: delegates to the European Forestry Commission and the Timber Committee had not had sufficient time to consider the study in detail and to draw their own conclusions.

After hearing the constructive criticisms and penetrating comments put forward by delegates, the Joint Meeting warmly congratulated the Executive Secretary of ECE, and Norris E. Dodd, Director-General of FAO, on the high scientific quality and the great value of the Study submitted to it and thanked the staff of the two Organizations who took part in its preparation.

It recommended that before publication the Study should be revised in the light of the comments and criticisms made at the Joint Meeting and of any observations subsequently submitted by Governments and experts. A Working Party composed of experts in forest policy, timber production, woodworking industry and timber trade should be established, the members to be selected by the Director-General of FAO and the Executive Secretary of ECE, after consultation with member Governments. It was agreed that this Working Party should be convened early in 1953 and should consider, on the basis of the discussions at the previous session, proposals for future action, so as to enable the Secretariat to draft recommendations for submission to member Governments well in advance of the next joint session, when the report would be considered and implemented as necessary.

It was understood that, prior to consideration by the joint session, the proposals of the Working Party would not commit the FAO European Forestry Commission, the ECE Timber Committee or Governments.

It was decided to hold the next joint meeting in Rome in the autumn of 1953.

Forest Policy — Delegations commented on reports presented to the Commission, drawing particular attention to those points having a direct bearing on the Timber Trends study.

As regards afforestation, reforestation, and forest improvement, the Commission approved the proposals of the Secretariat for a questionnaire to show the progress achieved in the period 1947 to 1952, and also agreed to the convening of a Working Group before the sixth session of the Commission to examine the replies to this questionnaire.

The Commission then directed its attention to points bearing specifically upon the Timber Trends Study and made certain recommendations to the Secretariat for the revision of Part II of the Study before publication, and for informing Governments of the opinions of the Commission on those problems which ought to be discussed by the Joint Working Party to be convened in accordance with the recommendations of the Joint Session.

Torrent Control and Protection from Avalanches—The report of the Working Group on Torrent Control and Protection from Avalanches, which met in France from 28 June to 8 July 1952 was submitted by P. Reneuve, representing J. Messines, Chairman of the Working Group. Mr. Reneuve stressed the desirability of close cooperation between all services concerned, especially in connection with the preparation of plans for large dams. Any meeting held in 1954 should be devoted more especially to the study of protection from avalanches, in a country where work in that field was particularly far advanced, such as Switzerland or Austria. The report was approved unanimously.

The Commission thanked the members of the Working Group for their excellent work and requested the French representative to convey its thanks to the French Government and the Direction Générale des Eaux et Forêts, Paris, for the excellent way in which the meeting and the accompanying study tour had been organized.

Sub-Commission on Mediterranean Problems — The report of the Sub-Commission on Mediterranean Problems which had met at Istanbul in May 1952 was submitted by Professor A. Pavari, Chairman of the Sub-Commission, who advocated holding a joint meeting with countries of a Mediterranean character in the Near East region. He also drew the Commission's attention to the recommendation for the setting up of national working teams for studying eucalypts.

The Commission unanimously approved the report and requested the Turkish representative to convey its thanks to the Turkish Government and the Forest Department at Ankara for the excellent way in which the Sub-Commission's session and the preceding study tour had been organized.

As regards the next session, the Commission requested the Director-General of FAO to fix the date and place in consultation with the countries which had already extended invitations or expressed the desire to offer hospitality to the Sub-Commission. It was desirable to hold a joint meeting with countries in the Near East, and perhaps with the International Chestnut Commission or the Working Party on Cork Oak.

Logging Techniques and Training of Forest Workers — The report of the Pilot Committee on Logging Techniques and Training of Forest Workers which met in Geneva from 23 to 29 March, 1952 was presented to the Commission by H. G. Winkelmann, Chairman of the Committee.

The Commission approved this report unanimously and expressed its thanks to the members of the Pilot Committee for the work achieved. It emphasized the importance of collecting documentation on this subject, particularly as regards the work which has been carried out or been planned in the different member countries.

The Commission showed great interest in the work undertaken in connection with the development of tractors for use in forestry operations. It was felt that tractors should be classified in categories according to the use to be made of them, with testing and reporting on the same basis. Data relative to practical use in the field were of paramount importance. The proposed inquiries should stimulate the production of tractors specially adapted for forestry work.

The Secretariat was congratulated on its collaboration in this field with the International Labour Office, the International Union of Forest Research Organizations and the Industry and Materials Division of the ECE.

The Commission gratefully noted the suggestion by the delegate of Finland that the next session of the Committee should be held in that country, in February 1953.

Statistics — The Commission unanimously approved the Report of the Statistical Working Group, which met during the session. This report related to forest fire statistics, conversion factors and the next FAO inventory on world forest resources.

Excursion — At the invitation of the Inspecteur général des forêts of Switzerland and of the Canton de Vaud, the Commission visited the forests of Risoud.

The visit provided a good illustration of many points discussed in the Timber Trends Study on the development of virgin or inaccessible forests, particularly the importance of roads, other means of access and exploitation generally.

The Commission expressed its gratitude to the forest services of Switzerland and the Canton, and to all those who organized the visit.

Election of Chairman — The Chairman indicated to the delegates that in accordance with the Rules of Procedure, the new Chairman must be elected from among the delegates present.

On the proposal of the delegate of Italy, seconded by the delegate of France, R. Schlatter, the delegate of Switzerland, was unanimously elected Chairman for the sixth session of the Commission.

The delegate of Sweden expressed to the retiring Chairman, on behalf of all delegations, their regret at his retirement and their appreciation of his services during the last four sessions.

Date and Place of the Sixth Session — It was decided that the Chairman, in consultation with the Secretariat, and having regard to the proposal for a further meeting jointly with the ECE Timber Committee, should determine the date and place for the next session.

Pulp and Paper Consultation

More than thirty prominent personalities[1] of the pulp and paper world met at FAO headquarters in Rome from 3 to 13 December 1952 to determine the feasibility and relative cost of making pulp and paper from tropical and sub-tropical woods and from agricultural residues. They discussed processes for pulping tropical broadleaved woods, bamboo, bagasse, straw and other agricultural residues, and also reached agreement on the adoption of uniform testing procedures for determining pulpability.

This high-level technical meeting was organized as part of the three-phase FAO drive to increase the world's supply of pulp and paper as a long-term policy.

The three phases are:

(*a*) a survey of potential possibilities for expanding the production of pulp and paper;

(*b*) advice in planning new mills, where these appear to be economic propositions, with due regard to suitability and continuity of raw material supplies;

(*c*) technical assistance in establishing such mills and in their initial operation.

The participants, who attended in their personal capacities and not as governmental representatives, included heads of pulp and paper research work at various institutes in Belgium, Brazil, Canada, France, Germany, India, Italy, Netherlands, Sweden, U.K. and U.S.A., six FAO technical assistance officers who had completed survey missions on pulp and paper possibilities in various countries, and six consultants who had helped in the preparation of the working documents for the meeting. Several were independent consultants engaged in the pulp and paper industry.

The basic documents were prepared by G. H. Chidester of the Forest Products Laboratory, Madison, Wisconsin, U.S.A., and W. E. Cohen of the Forest Products Division of the Commonwealth Scientific and Industrial Research Organization of Melbourne, and dealt with "procedures recommended for the investigation of new fibrous raw materials for paper", and "pulping processes for fibrous raw materials from new sources".

Under the able chairmanship of Dr. Chidester, the meeting was divided into four working groups,

[1] W. E. Cohen (Australia); E. Castagne (Belgium); L. Rys (Brazil); G. H. Tomlinson (Canada); J. Michon, R. Peteri, J. Savard, A. Villiere, J. J. Wilmot-Roussel (France); G. Jayme, R. O. H. Runkel, R. Schepp (Germany); F. Muller (Holland); R. V. Bhat (India); G. Centola, G. Consiglio (Italy); E. Hagglund, H. W. Giertz, B. Steenberg (Sweden); J. R. Furlong (United Kingdom); G. H. Chidester, V. P. Edwardes, J. A. Hall, W. O. Hisey, E. C. Lathrop, D. J. MacLaurin (United States of America); H. Baars, W. Barbour, R. Duckelmann, K. A. Forrest, H. Mueller-Clemm, A. Sundelin (FAO Technical Assistance officers).

each with its own chairman and secretary, to deal with the following:

Group I: methods and procedures for testing;

Group II: determination of processes suitable and products possible for:

softwoods, temperate broadleaved woods, tropical broadleaved woods;

Group III: determination of processes suitable and products possible for:

bagasse, bamboo, straw, grasses and other non-wood materials;

Group IV: consideration of engineering and economic aspects connected with the work of Groups II and III in the capacity of an advisory panel.

All those pulping processes which are in present commercial use were evaluated and their suitability for converting specific raw materials into paper clearly indicated. Among the processes expounded were groundwood, sulphite, sulphate, cold caustic soda, neutral sulphite, lime, caustic soda-chlorine and mechano-chemical. Particular attention was devoted to chemical, power and water requirements, as well as pulp yields, bleaching methods and pollution. Emphasis was given to the suitability of various fibrous raw materials for different paper products, and the usage possibilities of short fibre pulps for newsprint, kraft wrapping and container board. Tables were drawn up to show possible uses of pulps manufactured by different processes from such materials as mixtures of tropical broadleaved woods, eucalypts, bamboo, bagasse and straw. Estimates were prepared in an endeavour to illustrate comparative costs — including investment in plant and equipment — for each of the processes mentioned and as applied to the various raw materials considered.

Dealing with the selection of processes for future projects, the experts emphasized that there was seldom any necessity to consider novel or untried processes for mills that were to use new raw materials. Improvement of processes and development of processes to give higher yields, better pulp, by-products and better efficiency should certainly be encouraged, but this must be considered as an entirely separate problem. Starting an industry by using a new process for new materials merely involves tackling two problems when only one is necessary.

On the much-discussed question of utilizing bagasse for newsprint, the meeting declared:

> "Since it is not possible to make ground wood type pulp from bagasse (or straw and similar plant fibers), *conventional newsprint* cannot be made entirely from this material. Chemical pulps from bagasse (or straw), however, could be utilized — as a substitute for coniferous wood chemical pulps — in combination with groundwood for newsprint".

An important outcome of the consultations was the establishment of an FAO Advisory Board on Pulping Tests. With the help of this Board, FAO will now be in a position to arrange tests of the pulping qualities of raw materials from any given locality, as well as to ensure that these tests are carried out in line with agreed standards, and thus be internationally comparable. Moreover, it will be possible for these tests to be organised at minimum cost and without too much delay at the laboratory best located and equipped for the job. The world's leading pulp and paper laboratories will now co-operate with FAO in systematic efforts to create new pulping capacity in the less developed regions and countries.

As a result of the consultations, two reports will shortly be issued embodying the common views of some of the world's leading pulp and paper specialists on a number of widely debated and hitherto very controversial issues.

As Norris E. Dodd, FAO's Director-General, said during the closing stages of the Consultation:

> "I believe that within a few months it will be almost inconceivable for anybody seriously to consider the project of a new pulp and paper factory from non-conventional raw materials without consulting and carrying with him the texts which you are about to approve. One of your reports will guide bankers and governments, as well as the experts, by advising them what are the decisive criteria which determine whether or not their forests and fields are a possible commercial source of pulp and paper. Your other report [2] will help materially in overcoming rather widespread confusion by specifying for each major group of raw materials what pulping processes should be used and what kinds of paper they can yield.
>
> In addition to the contents of your documents, I believe this meeting has produced another even more significant achievement. The discussions and private talks which you have had since you came to Rome have created a wide area of agreement as to where we stand with regard to the *possibility* of developing pulp and paper capacity in those parts of the world which so far have produced and consumed only a fraction of what they need. Since they do not have the foreign currencies to step up substantially their pulp and paper imports, their consumption is not likely to rise to more adequate levels until they are able to develop some local sources of pulp and paper".

At the end of the two-week meeting the experts concluded that the development of a pulp and paper industry in the tropics can certainly take place, but its growth must be parallel to a broadly intensified and accelerated programme of research. They declared that such an industry could more than off-set any rising world demand for paper and newsprint, and that new materials in the shape of broadleaved forests, fibre-yielding plants and agricultural residues exist in combined tonnages of stupendous proportion awaiting exploitation. They agreed that:

1. Tropical woods, bamboo, sugar cane bagasse, straw, and various other agricultural residues, constitute raw materials for the industrial manufacture of paper.

2. A variety of well-established pulping processes are available for the conversion of these non-conventional raw materials. Selection of the most appropriate processes could now be made in the light of various local and technical considerations which were discussed at the meeting and are specifically indicated in the reports.

3. There can be no doubt that the world's potential supply of raw materials for pulping is plentiful and even abundant to meet any conceivable increase in the world's prospective requirements of pulp and paper.

4. Generally speaking, chemicals, power, transportation and — above all — money, are more expensive in under-developed countries than in industrialised areas, and it requires far more capital to establish an efficient pulp and paper operation in those countries than in North America or Scandinavia. The effect of these additional cost elements is, however, frequently off-set by the existence of cheaper wood and labour. Calculations show that the production costs of pulp and paper from tropical wood and agricultural residues can be higher, equal, or in some cases even lower than average production cost in Europe or North America, according to local circumstances. The experts' final statement read:

> "There is every reason to expect that given properly executed technical and economic plans, the large unexploited resources available can make a vital contribution to living in now under-developed countries. There must be a period of trial, a period of groping, patient capital, but if the means available are wisely used, there can arise a pulp and paper industry in the tropics that will be of world importance".

[2] *Procedures for testing and pulping fibrous raw materials* will also be included in this report.

Asia-Pacific Forestry Commission

Some sixty delegates from fourteen member countries participated in the second session, from 1 to 13 December 1952, of FAO's Forestry Commission for Asia and the Pacific at Singapore and Kuala Lumpur.

Countries represented were Australia, Burma, Ceylon, France (French Union), India, Indonesia, Japan, Korea, Netherlands (Netherlands New Guinea), Philippines, Thailand, United Kingdom (Federation of Malaya, North Borneo, Sarawak, Singapore), United States of America and Viet-Nam. W. H. Cummings, head of the FAO Regional Office for Asia and the Far East, represented the Director-General of FAO. Observers attended from the United Nations Economic Commission for Asia and the Far East (ECAFE), the United Nations Technical Assistance Administration (UNTAA), and the World Meteorological Organisation (WMO). The South Pacific Commission and the Pacific Science Congress were also represented.

His Excellency the Governor of Singapore opened the session and, in welcoming the delegations, said that the creation of the Asia-Pacific Forestry Commission was evidence of a general realisation that the problems facing forest services and industries were common to all countries, differing only in degree; their solution was a matter for consultation for the common good and not a matter for unilateral action. He was impressed by the manifest desire of all connected with the Commission to make concrete progress.

Mr. W. H. Cummings conveyed to the meeting a message from the Director-General of FAO, in which Mr. Dodd said that he felt sure that the enlargement of FAO's work through the Technical Assistance Programme had been at least a contributing factor in the forestry progress displayed in this region.

Election of Officers

Mom Chao Suebsukswasti Sukswasti (Thailand) having indicated his desire to retire from office, the Commission elected J. P. Edwards (United Kingdom) as the new Chairman. E. J. Shrubshall (Federation of Malaya) was elected first Vice-Chairman and Thiem Komkris (Thailand) second Vice-Chairman. F. G. Browne (Sarawak) was appointed Rapporteur for the session.

Forest Policy

All member countries of the Commission tabled progress reports on forest policy drawn up in accordance with the outline agreed at the Inaugural Session at Bangkok, which the Chairman said was a most gratifying response. The progress reported by countries was in fact remarkable but much still remained to be done. In particular, silviculture and management tended to lag behind progress in the field of utilization.

Delegates were given an opportunity to highlight features of their progress reports, and many interesting points were brought out in the subsequent discussions. India had published a new declaration of national forest policy; revised statements of policy were being formulated by Malaya and Burma; the extension of forest law to the outer islands of Indonesia was under consideration by the Government.

Several delegations emphasized the significance of the creation of unified Natural Resources Boards or Land Utilization Councils, a matter which had been given prominence at the Inaugural Session of the Commission at Bangkok in 1950 and subsequently at the regional Land Utilization Conference organized by FAO in Ceylon in 1951. In Timor (Indonesia) a committee was determining the areas that should be permanently allotted to agriculture, livestock production and forestry. Accounts were given of Natural Resources Boards or similar bodies newly created in Ceylon, the Federation of Malaya and Sarawak.

In Japan, as in India, the extension of controlled management to private forests was a marked feature of present policy. In the Federation of Malaya it had been possible to adopt a standard silvicultural system applicable to all the lowland dipterocarp forests.

As regards the utilization side of forestry, several delegates mentioned plans for new forest products research laboratories, training workshops, and modernization of extraction equipment. It was felt that the timber grading course organized by FAO and the Federation of Malaya and Singapore, and the mechanical logging school now being conducted by FAO and the Government of the Philippines, were definitely steps in the right direction. Industrial afforestation projects were mentioned, notably with *Pinus insularis* in the Philippines for pulp and paper production, and with *Pinus merkusii* in Indonesia.

The possibility of exports of timber, sleepers and fuelwood from Netherlands and Australian New Guinea was considered noteworthy.

A member of the United States delegation gave details of the military requirements, over the next fiscal year, for general light construction timbers, sleepers, and piling in Korea, Japan and the Ryukyu Islands and for teak boards in the United States. He indicated the respective purchasing agencies with whom interested exporters could get in touch. He also expressed appreciation for the assistance already given to Korea by member countries of the Commission.

At the conclusion of the general discussion the Commission agreed that member countries should continue to submit progress reports on forest policy in keeping with the outline already established, the next report being due in 1954. The Commission also decided to incorporate into the outline for the report a new item headed "Progress in Land Use Planning", to include progress in the inventory and classification of forest resources, and in the classification of soils.

It was agreed, too, that in their next reports countries should pay special attention to measures taken to stimulate the production and use of lesser known hardwoods, and review marketing prospects, both regional and overseas, for these timbers.

Finally J. C. K. Marshall (Federation of Malaya) gave an amplification of his paper "Sustained Yield and the National Conscience". This was received with acclamation and the Commission unanimously adopted the following resolution:

THE COMMISSION recommends that:

1. Member governments consider the advisability of arranging for instruction to be given to all students in schools, universities and teacher training colleges on the necessity of orderly long-term development and conservation of the nations' natural resources, including forests.
2. Member governments take steps to create in both working productive forests and in protective forests National Forest Parks which can serve as centres of recreation and tourism and help to instil an appreciation of the objects of forestry and of the value of forest conservation in the minds of the general public.
3. The attention of UNESCO be drawn to the need for education in planned long-term development of the renewable natural resources of soil, water, forests and wildlife and in the careful use of non-renewable mineral resources.
4. FAO initiate a co-ordinated service of visiting lecturers, of posters and other simple information material for reproduction in all languages, to spread the aims and ideals of sustained yield development of forests and other natural resources amongst the peoples of Asia and the Pacific.

Tropical Silviculture and Management

The Commission endorsed the following proposals and recommendations made by a committee set up under the chairmanship of E. J. Strugnell (Federation of Malaya).

Sustained yield: early action should be taken by member governments to extend silvicultural and increment studies in order to improve the sustained yield.

Silvicultural systems in rain forest: in mixed tropical forests further research was urgently needed to devise *practicable* silvicultural systems which would allow simplification of the composition of the crop without impairing the maximum and perpetual productivity of the site.

Prevention of undesirable changes in forest composition and site factors: the integration of forest industries

and complete utilization of each unit area was a desirable end, provided that silvicultural means could be designed which would prevent stand and site deterioration. It was essential that silviculture should be planned in consonance with technological requirements so that needs could be met from forests managed on a sound ecological basis.

Planting of exotics. The World Meteorological Organisation should recommend a standard scheme of climatic classification and produce a world map of climatic regions on these lines. The choice of exotics for trial planting should be based on such a classification.

Teak. (*a*) The FAO Conference should be asked to approve the formation of a sub-commission on teak, which should be competent to deal with all matters pertaining to teak production and use, including grading.

(*b*) The Director-General should be asked to arrange a teak study tour, in the near future, under FAO's Technical Assistance Programme.

Research. (*a*) There was a most urgent need for co-ordination in planning silvicultural research, for expert advice on research techniques and for specialised training of research officers. The Director-General of FAO was requested to consider means of meeting these needs in the region.

(*b*) The secretariat of the Asia-Pacific Forestry Commission should investigate the progress made at research institutes in the region in the silviculture and management of dipterocarp rain forest and prepare a statement for the third Session of the Commission, reporting the results achieved, research still required and methods of completing the study.

(*c*) Priority should be accorded by the secretariat to promoting a study of experimental design, plot size and data to be observed, for research into silvicultural treatments of tropical forests. Draft proposals for standard techniques and presentation of results should be prepared for consideration at the Third Session of the Commission.

Wood fuel. FAO should organize a survey of present and future fuelwood requirements in relation to available and potential supplies in member countries and advise on afforestation, cheaper procurement and distribution of fuelwood, and on increasing the efficiency of wood fuel burning equipment.

Financing of silvicultural operations. The cost of regenerating permanent productive forests being a first charge on forest revenue, a portion of forest revenue should be set aside annually as a Forest Fund which would supplement normal silvicultural forest expenditure and enable regeneration work to be continued despite economic fluctuations.

Mangroves. (*a*) The attention of the Governments concerned should be drawn to the need for preventing the clearing of the protective mangrove fringe in the Pacific Islands.

(*b*) There was need for organised research on:

(i) growth and yield of mangrove and associated species;

(ii) ecology of mangrove species;

(iii) mode of distribution of seed in mangrove forests;

(iv) comparative results of different silvicultural systems.

(*c*) Having regard to the superiority of charcoal over firewood for many purposes, the more complete exploitation that seems to follow from its production, and the possibility it affords for the recovery of other products now wasted, the production of mangrove charcoal should be encouraged, and research into the recovery of such products be undertaken.

(*d*) Attention was drawn to the desirability of giving more attention to mangrove forestry and of including in delegations to subsequent sessions of the Commission an officer with some knowledge of the problems encountered.

In the light of the discussions on the above conclusions of its committee, the Commission decided to establish a permanent committee on silviculture and management, charged with following up the recommendations of this session of the Commission in regard to silviculture and management.

Aerial Photography and Mensuration in Tropical Forests

The Commission took note of the working papers on this subject submitted for its consideration by the secretariat and various delegations.

After a brief discussion, it was decided to appoint an *ad hoc* working party, with P. Maurand (France) as Chairman, to study the broad aspects of the use of aerial photography in carrying out inventories of tropical forests, and also other general problems of mensuration in tropical forests.

At a later meeting, the Commission received the conclusions of this working party. After discussion of the issues raised, the Commission re-affirmed the resolutions on forest inventories and on enumeration methods adopted by the Forestry and Timber Utilization Conference for Asia and the Pacific, held at Mysore in 1949 (Resolutions Nos. XIV and XV of the Report of the Conference).

While appreciating the efforts made by the countries of the region to make as complete an inventory of their forest resources as possible, the Commission recognised that, in the present varying degrees of economic development of countries in the region, the completion of such inventories in five years as originally laid down was, in some instances, impossible. Nevertheless, by developing to its fullest potentialities the application of aerial survey to tropical forests, the completion of inventories could be greatly accelerated. The Commission recommended, therefore, that FAO should consider establishing a technical panel of experts which would be given the task of encouraging, selecting, and recommending for adoption specific experimental projects to be jointly sponsored by FAO and interested Governments; and assisting with their implementation.

The Commission recognized the increasing importance of statistical methods in studies of forestry and forest products, and suggested that, among the experts appointed to the panel referred to above, there should be one specialist in general statistics, who could advise on statistical methods applicable to forestry.

The Commission drew the attention of governments to the multiple use value of air photographs, and urged them to make available existing photographs to all land planning departments. In planning future photography, all such departments should be consulted.

Technical Assistance

W. H. Cummings, Regional Representative of FAO, made Technical Assistance the main theme of his speech delivered to delegates in the Council Chamber, Kuala Lumpur, on 6 December. Delegates also had before them a document on the Technical Assistance activities of FAO 1950-1952, and working papers prepared by the secretariat on important regional activities.

At a plenary meeting of the Commission on 10 December, various Technical Assistance officers of the FAO gave an outline of regional and national ETAP projects recently completed or currently in progress. In the subsequent discussion, delegates expressed their appreciation of the Fire Control Study Tour in the United States, the Timber Grading Course in Malaya, the Eucalyptus Study Tour in Australia and the Mechanical Logging Training Course in the Philippines. These projects were good examples of the readiness of member governments to promote the objects of the Technical Assistance Program.

Later discussions revealed many points which would be a valuable guide to the FAO Secretariat in considering future ETAP activities. The Commission recognised that the regulations governing the Technical Assistance Program were drawn up by the Technical Assistance Board, on which the various member governments of the region could exercise influence through the full FAO Conference. Delegations to that Conference should be briefed to support the recommendations put forward by this session of the Asia-Pacific Forestry Commission.

Increased Production of Pulp and Paper

I. T. Haig (FAO) explained to the Commission the origins of the FAO pulp and paper project which was now one of the more important activities in which the Organisation was engaged. Although the short-term position in regard to pulp and paper supplies was vastly changed from that of a year or so ago, the long-term position with which FAO was concerned had not altered at all, a fact recognized by the Economic and Social Council of the United Nations at its session in New York in the summer of 1952. No one could discount the vast potential demand for paper in Asia, or the importance of increased paper supplies in the fight against illiteracy.

Per Klem (UNTAA) gave the Commission a brief account of what was contemplated for the Philippines in the matter of increased pulp production, and afterwards delegates described the plans envisaged in their various countries. It was felt by some delegates that plans for pulp and paper production in the region, however well intentioned, might result in production costs in excess of current world prices. Enthusiasm for greater production must be tempered by commercial wisdom.

It was appreciated that much more intensive research was needed, both in pulp and paper chemistry and in the proper management of forests that could serve as sources of raw material for mills using new pulping techniques. An Australian delegate described experiences over many years in the pulping of hardwoods and particularly mentioned the need for research into the fundamentals of grinding and the treatment of short, thickerwalled fibres, and bleaching. This was of particular interest with regard to the possibility of pulping mangrove in New Guinea, thus integrating the pulp and tanning industries. Various species that were readily pulpable were sensitive to beating and yielded papers with poor tear strength. Australian experience with eucalypts gave hope that some tropical hardwoods might prove suitable for making paper.

Housing and Building Materials

The Commission recognised that adequate housing remained one of the most important problems of the Asia-Pacific Region. Forest products in various forms could play an important role in the solution of this problem. The United Nations had established an Inter-Secretariat Working Party to study all aspects of housing improvement and at its first sitting, held in November 1952 at Delhi, India, a resolution had been adopted emphasizing full collaboration with FAO.

The importance and value of timber, and its wide potentialities as a source of modern building materials, needed emphasis, particularly among administrators, architects, contractors, and others concerned with the direction of housing projects. The Director-General of FAO was asked to continue co-operation with the international and national agencies already working in this field, and to establish suitable machinery, under the Expanded Technical Assistance Program, to deal with the problem of the supply and use of modern building materials derived from forest products. The training of personnel, particularly in the use of modern woodworking machinery, should receive attention.

Standardisation and Utilisation

The Commission appointed U Chein Hoe (Burma) as the new Chairman of the permanent committee on standardisation and utilisation. This committee, during the course of the Commission's session, reviewed the reports of its various sub-committees; subsequently the Commission decided that the sub-committees on dimensions, sawn conifers, and sawn hardwoods indigenous to Australia, Japan and New Zealand should terminate their activities after the information collected had been circulated among member countries.

The following sub-committees would continue to function:

Testing Methods (A. V. Thomas, Malaya)
Nomenclature (K. A. Chowdhuri, India)
Grading of hardwood logs and squares (G. S. Brown, North Borneo)
Grading of sawn hardwoods - non-teak species (C. O. Flemmich, Singapore).

Visit to Kuala Lumpur

On 5 December, the Commission moved to Kuala Lumpur where, on 6 December, the members were welcomed by His Excellency the Officer Administering the Government of the Federation of Malaya and by the Member for Agriculture and Forestry. In his address to the delegates, His Excellency dwelt on the importance of the principles of forest policy enunciated by the Commission at Bangkok in 1950 and subsequently adopted by the FAO Conference, and gave a detailed account of the progress made by Malaya in following these principles. The Member for Agriculture and Forestry also addressed the delegates.

The following excursions were made in and around Kuala Lumpur:

5 December — A visit was made to the new Government timber depot and impregnation plant at Kuala Lumpur, where a demonstration of impregnation of power-line poles with Tanalith was given. The depot has a capacity of 125,000 cubic feet (3,500 m³) of graded, seasoned timber for supply to Government timber-consuming departments.

6 December — Sawmills near Kuala Lumpur were inspected where grading under the Malayan Grading Rules was demonstrated.

7 December — The Klang Mangrove Forest Reserves were visited and the technique of stick thinnings was explained.

8 December — Delegates visited the Forest Research Institute at Kepang, and were shown the experimental plantations, arboretum, Forest School, and the new Timber Research Laboratory.

Individual delegates took the opportunity of seeing lowland tropical rain forests in Negri Sembilan and Selangor.

FORTHCOMING MEETINGS

International Poplar Commission.	Munster and Munich, Germany 29 April - 8 May 1953
International Chestnut Commission	Spain and Portugal May - June 1953
European Forestry Commission ..	Rome October 1953
Seventh Session of FAO Conference	Rome Nov. - Dec. 1953
Near East Forestry Commission .	
Asia-Pacific Forestry Commission.	Spring 1954
Latin American Forestry Commission.....	
Third Conference on Mechanical Wood Technology	May 1954
Fourth World Forestry Congress.	Late 1954 or early 1955

Equipment News

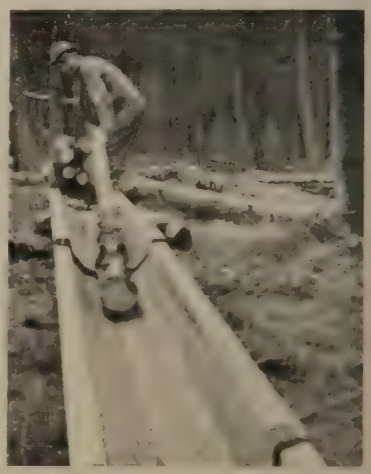
Interest in the development of forest utilization and wood working industries is reflected in the continual demand for information on new equipment. FAO's Forestry Division collects such information and passes it, on request, to Member Governments. Some of the information collected is published here. FAO accepts no responsibility for the claims put forward by manufacturers.

CALFDOZER. — Blade is carried on a tubular arm mounted pivotwise near centre of frame, and is raised and held at the desired height by a power hoist. Lowering is brake-controlled. A ripper attachment, interchangeable with the blade, is also available for use on hard surfaces. *Specifications*: 9 b. h. p. petrol, industrial type engine. Speeds, 1.4 m. p. h. forward; 1.6 m. p. h. reverse. Overall height, 4 ft. 7 in.; overall length, 7 ft. 1½ in., width of machine, 3 ft. 9 in.; width of blade, 4 ft. 6 in.; weight, 29 cwt.

Aveling-Barford Ltd., Grantham, England.

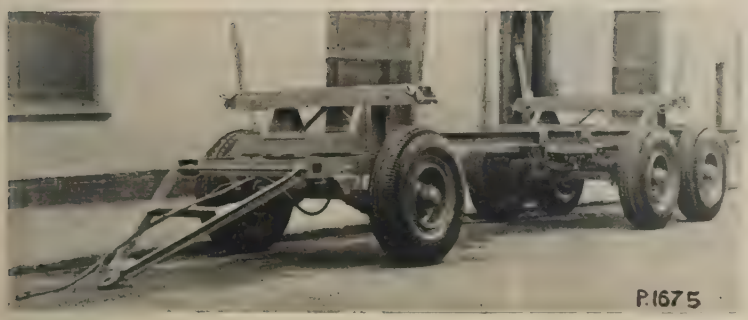
ONE-MAN CIRCULAR SAW. — Saw, which operates from any cutting position, is designed to fell trees, cut the limbs, buck the logs, stave bolts or cord wood, and to clear land. Blade is driven by means of a flexible shaft to which is attached a friction band applied by means of pressure on handle at top of saw frame, at the same time feeding saw to timber. Blade rotates at about 300 r. p. m. with power applied at outer edge, producing fast cutting with small power. *Specifications*: 30 in. blade of 15 gauge; weight of saw, 26 lb.; weight of engine, from 25 to 42 lb. Saw is available with 20 or 30 in. blades and is equipped with 2.2 or 3.6 h.p. air-cooled motor.

ALUMINIUM CHUTE. — Lightweight chute constructed under the direction of the Forestry Commission. Tests were carried out on an inaccessible site with 300 yds. of aluminium chute on a slope averaging 18°. 100 yds. of wooden chute on a slope of 28° fed timber into top of aluminium chute. Horse drag was used to assemble timber at top of chute. With aluminium chute dry, slope of 18° was not quite sufficient to keep logs running, but with the addition of a little water they ran well. *Specifications*: composed of 8 ft. long sections using 8 ft. × 2 ft. 6 in. sheets, 914 gauge; weight of one section, 24 lb. Sections are connected by pegs and sockets, so that no loose parts need be carried.



A. P. Metalcraft, Ltd., Coventry, England.

Barker Saw Co., Box 925, Commercial Sta. Springfield, Missouri, U. S. A.



EAGLE POLE TRAILER. — Designed to carry English timber. Two wheels are fitted to front axle and 4 to the 2 rear axles. Trailer is constructed of rolled steel [illegible] trically welded, and is equipped with 12.00 × 20 single pneumatic tyres. Pole is fitted with [illegible] wheelbase can be adjusted from a 12 ft. minimum to 24 ft. maximum length. Two bolsters are provided, one over front axle and one over rear bogie. Brakes are servo-operated.

Eagle Engineering Co. Ltd., Eagle Works, Warwick, England.

"SABRE" SCRUB CLEARING MACHINE. — Designed for use with the Nuffield Universal tractor. Consists of a 4½ in. diameter steel tube on left side of tractor frame (as seen from driving seat), and at the rear end has a spiral bevelled gearbox to which is fitted the driving pulley. Cutting blades available: 100 tooth saw blade with cutting capacity of 18-20 in. diameter growth and 4 cutter slashing blade with cutting capacity of 4 in. diameter thick growth (both blades have 48 in. diameter).

J. Foster and Co. Ltd., North Cave, Brough, Yorks., England.

AUTOMATIC AIR TONGS. — Tongs are adaptable to inside or outside dipper sticks of any make or size shovel. Three steel clamps on the lower inside of each tong give a position grip on the log. Equipment for tongs is a 30 cu. ft. compressor producing 100-150 lb. air pressure; 20 × 48 in. air tank is usually installed with piping to locate control valve handy to the operator. If dipper sticks are hollow, pipe is installed through them and connected to hose which runs to operating valve at one end and to a 2-way air cylinder, mounted on the tongs. The extension or adapter is easily mounted on dipper sticks. It can easily be removed to replace dipper on sticks for excavation work. It varies in length from 4 ft. to 6 ft. depending on size of shovel.

Berger Engineering Co., 3236 Sixteenth Avenue, S. W., Seattle 4, Washington, U. S. A.

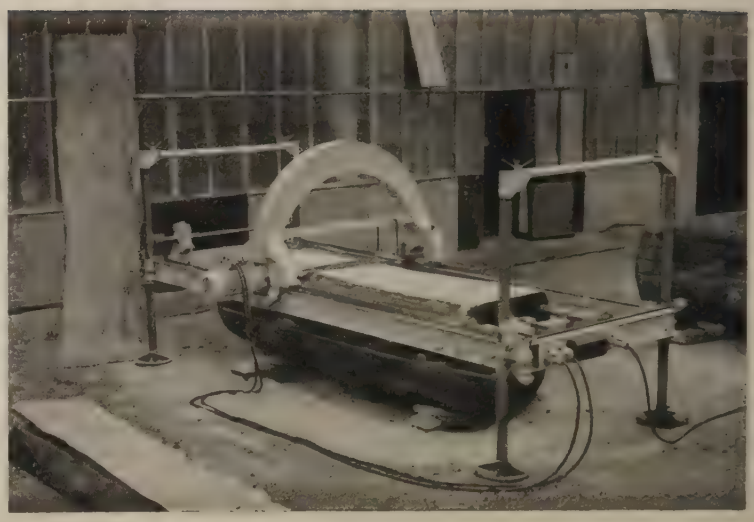
ALL-STEEL HYDRAULIC LOG AND LUMBER CART. — Cart can be hitched to rubber-tyred tractors of any make. Operations of loading, hauling, dumping or lowering of lumber are carried out by the tractor operator. Hydraulic lift is driven by the tractor's motor. Hoisting capacity, 12,000 lb. It is built to carry 16 ft. timber, balanced and levelled, clear of the ground. Longer lengths can be carried, but unbalanced. Load capacity: logs to cut up to 600 ft. and lumber from 1,000 to 1,500 ft.

Barstarke Equipment Co., Richmond, Virginia, U.S.A.

ELECTRIC TRANSPORTABLE SAW BENCH (PPK 200). — The bench, which has a rigid frame and is mounted on four supports, can be easily dismantled; overall weight, 90 kg. Motor and cutting unit are held by a curved support which moves lengthwise, and raising and lowering are operated by a special winch.

Specifications: Motor; air-cooled, 2 or 3-phase A.C., 50 cycle, 2,800 r.p.m., 14-16 h.p., 110/190 or 220/380 volts. Length of saw bench, 5 m. to 6.5 m., giving 3 m. to 4.50 m. maximum length of cut: width of bench, 1.50 m. giving approximately 1.40 m. maximum width of cut. Average speed of cut, 5-10 min./m² according to quality and dryness of the wood.

Etablissements P.P.K., 45-47, Boulevard St. Denis, Courbevoie, Seine, France.



HYSTER LIFT TRUCKS (*ZA-80* and *XA-60*). — Both models have gasoline engines and are mounted on pneumatic tyres. Special features include clutch that can be removed or installed in less than an hour, and disc-type industrial brakes. *ZA-80*: heavy-duty 8,000 lb. industrial truck with shorter over-all length and longer wheel base than most trucks of similar size. *XA-60*: 6,000 lb. version of ZA-80 with smaller dimensions.

Hyster Co., 2902, N.E. Clackamas St., Portland 8, Oregon, U.S.A.

UNIT DUST COLLECTOR "DUSTMASTER." — Almost every type of dust produced by a wide range of machines and processes can be effectively controlled. The "Dustmaster" can be supplied with one of five standard fans and motors, two different standard filter assemblies, and four standard dust storage containers. It is provided with a new type of flameproofed fabric filter which is kept in a dust free condition by means of a semi-automatic type of shaking gear, the operating handle of which may be fitted on either side of the unit.

Full accessibility of the fan, motor and filter is ensured by the provision of two large access doors. For handling dust the "Dustmaster" is provided with a quick release bin, the size of which varies according to the density of dust, and with handles for easy removal without spilling. Fan capacity range: 175-2,000 cu. ft./min. powered by motors from ⅓ to 2½ h.p.

Dallow Lambert and Co. Ltd., Spalding St., Leicester, England.

HYDRAULIC PORTABLE FLOOR CRANE (Model HP-3). — This crane is built in 6 models having capacities of 1-2 tons and 3 tons. Standard 1 ton model has lifting range from floor level up to 9 ft. 7 in.; 1 ton model for bus motor work has lifting range up to 8 ft. 4 in.; standard 2 ton and 3 ton models have lifting range up to 10 ft. 5 in. These cranes have only two operating controls —pump lever for raising the load and release valve for lowering it.

Ruger Equipment Co., Inc., 2425 St. Clair Avenue, Cleveland 14, Ohio, U.S.A.

News of the World

The items appearing here are condensed selections of news thought to be of interest to readers of UNASYLVA. *They are grouped alphabetically by countries under headings currently used by the Forestry Division for [illegible]. FAO assumes no responsibility for statements in news items accepted in good faith from outside contributors.*

General

Ceylon

• A recent issue of *Sri Lanka* published by the Government Information Department in Colombo is taken up entirely with a well-illustrated description of forestry research and education in Ceylon. The report describes the value of forests to the country, the need for and scope of forestry education, including the current status of the Forestry Field Training School, as well as the work being done on silviculture, utilization and timber research. The latter group of studies, especially with regard to seasoning, preservation and wood working of previously little-used Ceylon timbers, is of particular interest.

Japan

• Japan's schooling system has been reformed during the postwar years as follows:

1. 6 years in elementary school;
2. 3 years in junior school;
3. 3 years in senior high school (including vocational high school);
4. 4 years in the university.

In elementary and junior schools attention is paid to developing an understanding of the forest through the "greening" campaign and school forests. Senior high schools for agriculture and forestry aim at training junior forest technicians. In some schools, silviculture and general forestry are included in the general agricultural course, while forest experts are trained only at university level. The number of universities teaching forestry is as follows:

State universities – 18 (annual graduation 506)
Public universities – 3 (annual graduation 100)
Private universities – 2 (annual graduation 230)

Mexico

• *El Servicio Forestal de los Estados Unidos*, by Ing. G. Borgo, a Mexican forester, is the result of almost 12 months' work with the United States Forest Service during which the author travelled 28,000 kilometers visiting different regions of the country. There is no other comprehensive study in Spanish on the organization and work of the U.S. Forest Service; it should be of interest and assistance to Latin American foresters and provide those who are Spanish-speaking with a handy reference to many phases of forestry. The book consists of a factual description of what the author saw during his time in the United States and is divided into four parts:

1. the organization of the U.S. Forest Service;
2. silviculture and various other activities in the national forests;
3. forest research;
4. suggestions for conservation and better utilization of the forest resources of Mexico.

Nepal

• The following is a description of a day's journey south from Khatmandu by an FAO officer:

"Towards 10 a.m. we set out to climb to the summit of Chandragiri (2,500 m.). The forest was heavily exploited and reduced to scrub in the lower regions and more gentle slopes; as we got further from the village (Thankot), trees became more frequent, but were misshapen and only suitable for fuelwood. At 2,000 m., the level at which the fog belt started, trees were covered with moss and lichens and were for the most part species from dry climates, in particular evergreen oaks (*Quercus semi-carpifolia*, *Q. lanuginosa*).

"We found here, as in numerous other districts of this part of Nepal, the vegetation of dry and wet zones growing side by side — particularly on the rainy slopes and in the fog belt. This is explained by the fact that during three months of the year about 2,500 mm. of rain falls on the western slopes, but during seven months it scarcely rains at all, apart from occasional winter rain. It is clear that such a mixture of species could only occur in a forest which is sufficiently dense to remain moist throughout the greater part of the year. But even in the densest areas there was no true forest. The oaks were used for provender during the dry season; they were, therefore, misshapen, being stripped of their leaves and branches each year, and, in general, old and incapable of producing good seed. Indeed, regeneration was non-existent, and the forest as a whole was unproductive of wood, its main purpose being to supply grazing.

"After we reached the pass, the forest changed to a dryer type, consisting solely of oaks well-spaced with grassland between them, the trees becoming scarcer towards the inhabited areas. In general, the mountain summits of this region consisted of pastureland, for two reasons:

1. the presence of fog over a certain altitude, which provides the necessary degree of moisture to keep the grass fresh over a long period;
2. relatively gentler slopes towards the summits, producing good permeable soil.

There were several stands of *Pinus longifolia*, well-grown but limited in area. Descending the valley, the forest gradually died out, giving place to sparse pastureland, annually swept by fire. However, I saw no trace of erosion in the valley, not even soil denudation, since grazing cattle have created a network of paths following the contour lines, thereby slowing up water run-off.

"After three hours' walking in the valley we began to climb the Chisapani (8,000 ft. or 2,700 m.). The forest began at approximately 6,000 ft. (1,800 m.) and was composed mainly of *Quercus* mixed with *Alnus nepalensis* in the moister depths and various species of *Michelia* and rhododendrons in the less damp regions. As on Chandragiri, trees were misshapen and there was no regeneration".

The officer went on to describe the transport difficulties of Nepal, typified by this region. The road he followed was the only one from Khatmandu to India, much of it inaccessible to motorized transport and goods were therefore carried on the backs of coolies. Consequently it is impossible for Nepal to export any products of the high mountain regions, in particular forest products. The luxury of transport by lorries at Khatmandu and in the valley represents a cost to the State of 50 million rupees per year, or approximately half the value of the exports.

United States of America

• Dr. Raphael Zon, formerly director of the American Journal of Forestry and director of the Lake States Experimental Station at University Farm, has been awarded the Gifford Pinchot medal, given for outstanding services to the forest industry. The award was made in Montreal at a joint meeting of the Society of American Foresters and the Canadian Institute of Forestry.

Dr. Zon is the father of the great forest belt planted across the plains states during the drought of the 1930's to prevent erosion of top soil. Born in Russia, he emigrated to the United States in 1897 and graduated from Cornell University with a degree in forestry. He was a friend of

Theodore Roosevelt, Gifford Pinchot and other prominent conservationists, and has long been associated with FAO.

Fundamental Science

Australia

• After early and spectacular successes with *Pinus radiata* and *P. pinaster* on good soils in Australia, plantings were extended to poor soils which were more abundant and open to forestry against the competitive demands of agriculture. In due course, many of the latter plantings proved to be unhealthy and were very slow growing. Thus, over a quarter of a century ago, investigations of the causes of ailments and possible remedial measures were undertaken in Western Australia, taking the form of applications of inorganic materials. About 30 substances have been tested, of which two, phosphorous and zinc, have been of value. Tests were made, both in correcting and improving ailing stands, and as a preventive when establishing new plantations on poorer soils, particularly those of the coastal sands. In the course of the work, methods of application, which vary for established and newly planted stands, have been worked out and considerable information has been obtained on optimum dosages for different soils and tree species, although further work needs to be done in that respect.

The effect of a corrective treatment is lasting if it induces sufficient growth to close the canopy and impose complete control of the site, and satisfactory growth following a single treatment has been maintained for as much as 16 years. Similarly, natural regeneration of *P. radiata* has been prompt on a fire-killed area previously treated with zinc, whereas on similar untreated soils regeneration failed.

Improvement in growth following chemical treatment has resulted in many commercial stands which, without treatment, would have stagnated or died at the height of a few feet; among them is the commercial development of 3,000 acres (1,200 ha.) of plantations on coastal sands, the success of which is entirely due to superphosphate, the cost of which is only one percent of the total cost of the stands to date.

Since forestry will be chiefly restricted to poorer soils, both because of competition from agriculture and because such soils are abundant near the main markets, the results of the studies are of the greatest significance in Australia, and use of zinc and superphosphate has now become standard practice when dealing with the types of soils on which their use has been proved beneficial.

Union of Soviet Socialist Republics

• Plant physiologists have known for some time of the existence of substances, chiefly in the upper buds of stems, tips of roots and seeds, which promote growth. It was only after these substances were isolated in their pure state, known as heteroauxin, and could be produced synthetically, that their application in stimulating plant growth became of practical importance. Heteroauxin was found to be betaindolilucacetic acid, already known to chemists.

Soon, after some experimentation, it was found that plant growth can be stimulated also by other organic acids such as alpha-naphtolacetic, dichlorphenacetic acids, and others.

In 1947, the Institute of Plant Physiology of the Timiriazev Academy of Sciences in Moscow undertook systematic experiments to determine the effect of growth stimulating substances upon the restoration and development of the root systems of transplanted trees, and on the rate of growth of the whole tree. The experiments were carried out on seedlings of lime, oak, ash, larch and other species, and on 18 and 40 year old lime trees. Heteroauxin, dichlorphenacetic and alpha-naphtolacetic acids were found most effective in repairing the roots damaged in transplanting, in increasing the survival and in stimulating the growth of seedlings as well as of large trees. In the case of transplanted seedlings of lime, oak, ash and others, treated by these acids, their roots at the end of the first vegetative season increased from two to three times in comparison with those which were not treated.

The enlarged root systems in turn affected the growth intensity of the whole tree. Lime seedlings for instance, after treatment, showed a 40 percent increase in both height and diameter compared with untreated ones. This accelerated growth was maintained during the second and third year. The effect of treatment was particularly pronounced in the case of transplanted 18 year old lime. The volume of their roots increased ten times, their height growth 147 percent, and their growth in diameter 300 percent compared with the untreated ones. This acceleration continued for the next three years. Similar positive results were obtained in treating some 1,500 transplanted 40 year old lime trees.

The treatment itself is comparatively simple. In the case of small seedlings, bundles of seedlings before transplanting are submerged to the depth of the root collar for 24 hours in a solution of heteroauxin or dichlorphenacetic acid of 0.001 percent concentration (diluting one gramme of acid in 100 litres of water). One gramme of the stimulator is enough for the treatment of 5,000 small seedlings. In the case of larger trees, instead of a liquid solution, a paste of clay and peat is used. The larger the tree the thicker the paste. In the case of very large trees, all roots that were cut in taking the tree out of the ground and which protrude from the ball of dirt that envelops the root system, are smeared with this paste. After the tree is planted, a liquid solution is poured into the ground, about 10 to 20 liters for small trees and 50 litres for each of the larger trees. The use of stimulators assumes greatest importance in planting difficult sites or in regions of deficient rainfall.

Silviculture

Cambodia

• The Cambodian forests may be divided into

1. inundated forests, comprising the mangroves (*Rhizophora conjugata* and *R. mucronata*) bordering the sea; the rear mangroves (*Melaleuca leucadendron*); the forest on the borders of the Great Lake; and the riverain forests;

2. the non-inundated forests, comprising low-altitude forests subdivided into dense and open forests, and high altitude forests.

The low-altitude dense forest is considered the basic forest type of Cambodia; it comprises 1 million ha. of equatorial type (rain forest) and 2 million ha. of monsoon type (seasonal forest) and delivers all large dimensioned timber utilized in Cambodia.

This presents difficult regeneration problems once the balance of nature in the virgin forest is disturbed by human action, and an area of probably 3-4 million ha. has thus been transformed into open forest which now covers a total of 5 million ha. and is the subject of frequent fires and of laterization of the soil. In the high altitude forests (400-1000 m.), the most remarkable stands are those of *Pinus merkusii* extending over 50,000 ha., and of *Podocarpus cupressinus* (or *Equisetifolia*) and *Dacrydium elatum* (800-1,000 m.) equally about 50,000 ha.

The problems of regeneration of the open forests and of bamboo, but in particular of the dense forests, as well as transformation of the mixed teak forests into pure teak, and management of the pine forests, are at present being studied.

Canada

• A note in *Unasylva* Vol. VI No. 2 page 88 described a regeneration survey carried out in Canada. This survey was carried out by the Forestry Branch of the Department of Resources and Development, and the results are embodied in *Silvicultural Research Note No.* 92 " Reproduction on Cut-over and Burned-over Land in Canada ". No work was in fact done within the montane, coast or Columbia regions, and no sampling was undertaken in the interior plains, sagebrush-grass grassland formations or tundra formation.

Union of Soviet Socialist Republics

• Three years (1949-1951) since the inauguration of the ambitious afforestation plan is too short a period

by which to judge its success, yet certain weaknesses of too rapid expansion of the programme are becoming evident, which will become more marked as time goes on. The real work is in securing a high survival of the trees planted and in providing continuous care for the plantations over many years. As a result of the lessons already learnt by hard experience, there is a change in emphasis and a new approach. Although there is no perceptible slackening in the annual rate of new planting, efforts are now being directed toward greater care for the plantations already established. The slogan today is: "without intensive care for the young plantations, there can be no successful planting in the prairies".

On the credit side the showing made by forest planting during the last 3 years is high, amounting to 2,066,000 ha., including 1,033,200 ha. of shelterbelts around cultivated fields; 45,300 hectares on the state-wide forest barriers; 56,200 ha. of commercial oak plantations; 216,000 ha. of gullies and other eroded areas; 220,300 ha. of shifting sands and 495,300 ha. of other miscellaneous planting. In addition, about 15,000 million seedlings were grown and 127,000 tons of seed of different tree species collected.

On the debit side of the picture are these facts: in the shelter belt plantations, where oak is the principal species planted, and in other oak plantations only 54 percent of the areas planted have a satisfactory stocking (5,000 seedlings per ha.); 21 percent of the oak plantations have only a fair stocking (from 2,500 to 5,000 oaks per ha.) and needed additional planting during the spring of 1952; 14 percent of the areas planted have unsatisfactory stocking (fewer than 2,500 seedlings per ha.), and 11 percent have to be completely replanted: thus 46 percent of the total area is in need of either supplemental planting to fill in the unsuccessful places or of complete replanting. In the light of these results the field force has been instructed, as of 1952, to shift the emphasis from pushing new planting to taking care of the earlier plantations and to bringing them up to the accepted standard of stocking. The afforestation project thus enters a new stage in its development.

Mensuration and Surveying

Germany

• The volume tables (*Massentafeln*) by Grundner-Schwappach which have served for more than half a century as the most reliable basis for forest surveys and related scientific investigations have now been brought out in a tenth edition. The present edition is the result of years of detailed research work in Austrian and German Forest Research Institutes, and in addition to ordinary mensuration tables contains auxiliary tables for the establishment of different assortments of logs, the valuation of single stems and stands, and the production of high quality timber. There are also tables for the application of height curves to simplify height mensuration, as well as new volume tables for red oak and Japanese larch.

Industry and Trade

Australia

• The consumption in Australia of timber primary products of all types in 1950 was about 420 million cubic feet (12 million m³) in terms of round lumber, true measurement, of which approximately 31 million cubic feet (900,000 m³) were imported. About 240 million cubic feet (7 million m³) of this were sawn, the bulk being used for housing and other building and construction. Manufacturing industries such as furniture, agricultural implements, turnery, cooperage etc. utilized about 38 million cubic feet (1 million m³) and wooden cases about 30 million cubic feet (850,000 m³). In addition, approximately 7 million cubic feet (200,000 m³) were used for plywood and veneer and about 12 million cubic feet (340,000 m³) for sawn and hewn sleepers. Approximately 14 million cubic feet (400,000 m³) were used for pulpwood for manufacture of paper and other pulp products, including hard fiberboard. The balance were used for round and split timber, including mining timber, hewn timber and firewood. Actually firewood consumption is believed to be much greater than indicated from records available.

The pulpwood equivalent of imported pulp and paper in 1950 represented an additional consumption of about 50½ million cubic feet (1,400,000 m³).

Sawmilling represents the main industry using forest products in Australia. There are about 2,700 sawmills, with a capacity of about 300 million cubic feet (8,500,000 m³) log volume. The current intake is about 70 percent of estimated capacity. Nearly 70 percent of the mills are very small and produce about 25 percent only of total production. A comparatively recent development is the utilization after immunization of many lyctus susceptible species formerly not used.

There is a tendency towards the establishment of larger sawmilling units in some localities so as to provide amenities for a permanent labour force, and for the more complete utilization of timber by dimension cutting and production of more diversified products.

The plywood industry, which now embraces about 50 plants, first developed in Queensland cutting mainly hoop and bunya pine. Plywood mills are still most numerous in Queensland, but with reduction in supplies of hoop pine logs other species, including imported logs, are now largely used. Many plywood mills also now exist in other states, principally New South Wales.

The manufacture of pulp for paper of various types, cardboard and hard fiberboard is using increasing quantities of timber, much of low quality, and is providing considerable employment in the forest and mills.

The total number of persons employed in forests and forest industries in 1950 was about 125,000. This does not include the very considerable number of persons engaged in the building industry which utilises the largest proportion of sawn timber.

United States of America

• An analysis of the economics of hardboard manufacture gives the following facts: hardboard is a synthetic board with a density of 0.9 to 1.2, made of wood fibers generally ⅛ to ¼ inches (0.3 to 0.6 cm) thick, with modulus of rupture of 5,000 to 6,000 per sq. inch (775 to 930 per cm²), and modulus of elasticity of 500,000 to 600,000 per sq. inch (77,500 to 93,000 per cm²). About one ton of hardboard is obtained from a cord of wood. A plant of economic size is of 50 ton capacity and, at current prices, this will cost approximately 1 ½ to 2 ½ million dollars. The fixed charges are 36 percent, conversion costs 38 percent and materials cost 26 percent.

Freight rates are a highly important factor to consider in location of plants, since rates from the Pacific Northwest are about twice as great as those from the Mississippi delta and about three times as great as from the Atlantic seaboard to the principal consuming areas for hardboard. Abundant cheap natural wood supplies are therefore not the controlling factor in determining economic feasibility or location of plants.

Forest Products and their Utilization

Brazil

• The following extract is taken from the book *The Amazing Amazon*, by Willard Price, published by William Heinemann Ltd:

"It has been estimated that Brazil annually burns as much timber as the United States uses. Seventy-one percent of Brazil's fuel energy comes from wood (2 percent in the United States). I have seen hundreds of cords of precious mahogany and rosewood brought aboard the river-boats as fuel for the steam boilers. Wood superior to the Circassian walnut provides piles for landing stages and supports for shacks. Logs thrown across streams turn out to be woods better than costly teak. The isolated rubber worker needing a plank, and lacking a sawmill, fells a fine tree and hacks and hews at it for weeks to reduce it to the desired thickness. Priceless woods rot on the ground.

"The number of known species of Amazon trees totals more than eight thousand — ten times the number

in the whole United States. A dendrologist found 117 distinct species within half a mile. A timber explorer estimates that while an acre of forest land in New York State will scarcely provide more than half a dozen commercial woods, the same area in a typical Amazonian forest would show more than fifty varieties.

"All this is vitally important to the pioneer and opens up to him a profession rather new in the world - that of forest farmer.

"We have traditionally thought of a farmer as one who clears the ground of trees and raises vegetables, grains, fruits and livestock. The average farmer of the temperate zone sees trees merely as something to be got rid of, except those few that can be used for lumber or to make pulp for his newspaper. His trees would deserve and get more respect if, like those of the Amazon, they could provide food, drink, rubber, belting, industrial oils, ropes and fibres, wax, chewing-gum, insulation, bedding, insecticides, medicines, buttons, dyes and hundreds of other articles of daily use.

"The finest of woods for furniture, cabinet work and house-building are here in profusion. There are woods of lovely grain, and grainless woods as smooth as butter. There are soft woods and hard woods, the percentage of the latter sometimes rising to 70 percent. How a tree can grow so fast and yet be of such firm flesh is one of nature's mysteries. Many trees are so solid that they promptly sink when placed in water. Their wood is so hard that it brings a circular saw to a shuddering halt. They are almost as good as steel for building the hulls of ships and will wear interminably.

"But the tree-farmer is not just a lumberjack. He cuts down trees needed for their lumber, but he gets his best return from the trees he leaves standing.

"The majestic castanha, two hundred and more feet high and forty feet round, drops a four-pound cannon ball and woe to the head that happens to be in the way of it! The ball is tightly packed with Brazil nuts, highly nutritious, two of them having the value of an egg.

"The tall handsome babassu palm yields a nut that is shipped in great quantities to Europe and North America to be made into soap, lubricants, margarine and medicinal products. Even the shell of the nut is useful. From it is extracted methyl alcohol, acetic acid, dyes, rosins, calcium and acetate. The leaves make straw-hats, baskets, mats and sieves.

"The coconut, of course, is a tree of a hundred uses, as the South Sea islanders know well. For them it is indispensable, since there is nothing to take its place, but in Amazonia it is only one of dozens of trees equally useful. It thrives near the mouth of the Amazon within reach of the salt tides.

"The cashew is a versatile tree, supplying a fruit that makes a refreshing drink and a delectable jelly, a nut highly popular throughout the world and oil for use in brake linings and the magneto armatures of aeroplanes.

"When China is unable or unwilling to give us tung oil needed for paints and varnishes, Brazil can supply the lack with oiticica oil which fills exactly the same purposes.

"From the assai palm comes a cooking oil, from the bacaba a substitute for olive oil, from the jupati an oil to improve soap, from the inaja an oil for cattle cake, from the murumuru palm fats and oils of high nutritive value, from the andiroba an oil remarkable as a soap base and illuminant, from the cupuassu a good substitute for cocoa butter, from the jaboti a grease that resembles suet, from the mamorana and the piquia oils superior to lard, from the castanha de arara medicinal oils — but space is lacking to go on to detail the uses of the oils of the patawa, bacuri, baratinha, castanha sapucaia, marfinzeiro, copaiba, nhamui, ocotea, copal, muiratinga, pau rosa and many others.

"Then there are the trees that bear precious beans and berries, tonka beans for perfume, gumaru for the same purpose, vegetable ivory for buttons, guarana berries for that wonderful Brazilian drink now being popularized in America and Europe, vanilla beans, castor beans, coffee and cocoa beans, and a tiresome list of beans with strange names but important uses.

The problem of how profitably to farm any particular tree when it is mixed in with dozens of other species is being solved in various ways. The problem diminishes if the farmer is interested not merely in one species, but in all. Thus he does not pass by a hundred trees to reach a rubber tree, but harvests the carnauba for its wax, the cinchona for its quinine, the piassava for its fiber, the cork for its insulating materials, and so on. To do this he must first be trained thoroughly in a school of agriculture and forestry".

United States of America

• A detailed nationwide study of equipment, supplies and manpower used by the primary forest products industries has been reported by the United States Forest Service. Carried out in co-operation with the National Production Authority, this study divided the country into west, north and south groups of states and the industries into lumber, veneer, pulpwood and all others. It aimed at providing a basis for estimating the amounts of equipment, supplies and manpower required to sustain given levels of production in the primary forest products industries. The comprehensive data were obtained by field interviews of sample logging operators in each of the industries.

Forest Policy

Burma

• Proposals have now been put forward by the Forest Department for the issue of a revised and concise statement of forest policy. Special legislation will be necessary to give effect to this forest policy. The Burma Forest Act became law in 1881 and a simpler code was imposed in Upper Burma in 1887. The Burma Forest Act in its present form was enacted in 1902 and extended to the whole of Burma including the Shan States. It included provision for the constitution of Reserved Forests and powers, rights and duties therein, the general protection of forests and forest produce, the control of forest produce in transit, penalties and procedure, and the investiture of Forest Officers with special powers. The Burma Wild Life Protection Act 1936 and the Rules thereunder framed for the protection of the fauna of Burma, are still in force but the Forest Department has submitted proposals for their revision.

China

• According to official statistics issued by the Ministry of Forestry, created in 1950, the total forest area covers 50 million ha. exclusive of bamboo thickets and small privately owned woodlots. This constitutes only 5 percent of the total land area. Such a low percentage of forest land is due first of all to the fact that a large portion of China is desert. Much of the forest, however, was also destroyed by clearings, extended over centuries, for timber, agriculture and fuelwood and also by fires. At present, more or less extensive forests are found only in the mountainous regions of China and along its boundaries with other states — in the northeast (Manchuria), northwest, southwest (including Tibet), in the south, and on the Island of Formosa. The provinces in which there is the largest concentration of forests (more than 4 million ha.) are: Heilungkiang, Szechwan, Yunnan, Kirin, Inner Mongolia, and Hunan. The timber cut in 1950 amounted to 4.5 million m^3, or 500,000 m^3 more than in 1949. The stumps were cut to a height not greater than 30 cm., as against a stump height of 70 cm. in 1949, resulting in an additional 250,000 m^3 of wood. A more rational utilization of the branchwood further increased the yield of wood by 50,000 m^3.

For a period of 13 years (1927-1940) China imported timber to the amount of 13 million silver dollars a year, but the present timber needs of the country are met from its own resources. In North-eastern China and in Inner Mongolia, the two most important centers of the timber industry, timber cutting has been stepped up considerably. Some 287 km. of new forest railroads have been built to facilitate log transportation. At present more than 2,600 students are receiving forest training in several special institutes and universities.

There are more than 275 million ha. of devastated land on both mountain and plain that need reforestation, and plans are underway for reducing this acreage by half in the next 30 years. In 1950, 123,755 ha. were planted to forest; in 1951, 462,670 ha.

and in 1952, 696,000 ha. One of the largest planting projects is the creation of forest strips within a belt that extends for 1,700 km. and is 300 km. at its widest point in northeastern China; the belt, which runs. from north to south, starts at Fuyu in the province of Heilungkiang and ends at Shanhaikwan in the province of Hopeh. It includes an area of 20 million ha. ($^1/_5$ of the entire territory of northeastern China) of which 3 million ha. will be occupied by forest plantations.

Nyasaland

• The British Protectorate of Nyasaland, " Land of the Lake ", a strip of territory 37,928 square miles (9.8 million ha.) in extent, occupies the escarpment of the African Rift Valley on the western shores of Lake Nyasa, the third largest of the Great Lakes of Africa. In contrast to much of the surrounding territories of Northern Rhodesia and Portuguese East Africa, it has an exceedingly broken topography, with altitudes ranging from a mere 190 feet (58 m.) above sea level at Port Herald in the southern end of the Rift Valley, to over 7,000 feet (2,100 m.) and 8,000 feet (2,400 m.) in the Central and Northern Provinces. The highest mountain is Mlanje, in the Southern Province, with numerous peaks exceeding 8,000 feet (2,400 m.), the highest being just short of 10,000 feet (3,000 metres).

Although lying well inland and several hundred miles from the shores of the Indian Ocean, Nyasaland receives considerably more rainfall than the Rhodesias and inland areas of Portuguese East Africa and, consequently, is comparatively well-watered, the majority of the streams and rivers being perennial. The climate, generally speaking, is sub-tropical rather than tropical, with a distinctly wet summer and dry winter, though in the higher mountain areas there are, at times, appreciable falls of rain accompanied by mist and drizzle, in the winter months. Except in the Rift Valley, where summer maximum temperatures of over 100° F (38° C) occur, temperatures are generally moderate and rarely exceed 95°F. (35° C.). Ground frosts occur in most winters on the central plateau at 3,500 feet (1,100 m.) and on the higher mountains over 5,500 feet (1,700 m.).

The forest vegetation is a rich one and ranges from temperate conifer forest (*Widdringtonia, Podocarpus* and *Juniperus*) at the higher altitudes, through montane evergreen and semi-evergreen forest to the deciduous forest and woodlands of the drier plateaux and Rift Valley. In common with surrounding territories, the greater part of the country over 2,000 feet (600 m.) in altitude is covered, where it has not been removed for agriculture, with *Brachystegia* woodland of varying density. The Rift Valley and Lake shore areas contain numerous dry forest types ranging from pure mopane (*Colophospermum mopane*) forest to dense acacia thickets and palm (*Hyphaene crinita*) stands.

The latest estimate of the area of forest land is 6,805 square miles (1.8 million ha.) of which 2,754 square miles (700,000 ha.) is State forest, 720 square miles (186,000 ha.) communal forest, and 202 square miles (52,300 ha.) privately-owned forest. The remainder is at present unallocated, but forest reservation is not yet complete, and it is probable that the area of State forest will be considerably increased during the next decade.

Up to the end of World War II in 1945, forestry activities on the part of the Government consisted mainly in control of exploitation of the more valuable forests, such as the *Widdringtonia* forests on Mlanje Mountain, reservation of the main mountain areas and catchments, botanical investigations, and a considerable amount of experimental work in connection with the introduction and establishment of plantations of exotic species, notably eucalypts and pines, many of which have been proved to be easily grown under Nyasaland conditions and of great economic value.

Since the War, and particularly in the last three years, there has been a rapid expansion of forestry activities on the part of the Government. A small staff consisting of a Conservator of Forests and three Assistant Conservators, has been expanded to a total establishment of twenty-four European officers, distributed at ten forest stations in the three Provinces. Specialist sections covering forest surveys, utilization and staff training have been established within the past year and it is hoped to complete this by establishing a silvicultural research section as soon as possible. The main tasks of the expanded Forestry Department are: continuation of the forest reservation programme and its completion; survey and demarcation of all State forests; road and building construction in the more accessible and valuable forests as a preliminary to the introduction of sustained-yield management; afforestation, mainly with softwood species, indigenous and exotic, at the rate of 2,000 acres (809.4 ha.) a year, in order to build up and safeguard the country's supply of softwood timber; and the development of forestry and the timber industry generally based on an adequate and soundly-managed forest area. Good progress is being made in all these directions, and the next few years should see the establishment of forestry and its related industries as an important feature of the life of the Nyasaland Protectorate.

Pakistan

• With a view to integrating forest policy for the country as a whole, the Pakistan Government has constituted a Central Board of Forestry under the chairmanship of the Minister of Agriculture. Ministers in charge of forests in East Pakistan, Punjab, North West Frontier Province, Sind, Baluchistan, and Bahawalpur will be among the members of the Board, which will normally meet once a year.

United Kingdom

• A three-man mission has been visiting the West Indies, British Guiana and British Honduras to investigate the possibilities of increasing the production and marketing of timber. The mission was sent in accordance with the Government's policy to promote in the short term greater development of the timber sources of British overseas territories.

The mission concentrated upon raising the output of the large number of varieties of timbers not yet fully worked. It surveyed their distribution and productive potentialities. An assessment was also made of the possibilities of extending the markets for these timbers in the Caribbean and in Europe.

Selected Reviews

RESOURCES FOR FREEDOM. A Report to the President by the Presidents Materials Policy Commission. 5 vols. Washington DC., 1952 $ 6.25

This report, known as the Paley Report, after William Paley, Chairman of the President's Materials Policy Commission, consists of the following five volumes:

I. Foundations for Growth and Security
II. The Outlook for Key Commodities
III. The Outlook for Energy Sources
IV. The Promise of Technology
V. Selected Reports to the Commission

In Volume I there is a chapter devoted to the recommendations of the Commission for making the most of timber resources. In this chapter is a very concise discussion of consumption and growth for the period 1950-1975, with particular emphasis on saw timber as the critical resource; meeting 1975 requirements with emphasis on the " two keys: technology and management ". The recommendations cover protection against fire, insects and disease, specifically asking for larger appropriations by the Congress; research on management and utilization; educational and technical assistance for the benefit of small owners, advocating the expanssion of present staff of farm foresters ultimately to the number of 2,000; expansion of planting on private land and establishment of forest credit and forest insurance. It also urges the revision of forest taxation laws by the States, and the regulation of private cutting by means of State laws which prohibit destructive cutting. Financial assistance from the Federal Government to this end should be on a fifty-fifty basis with the States. " If after 5 years there still remain important gaps in the State system of compulsory regulations, Federal legislation should be enacted authorizing the Federal Government to establish minimum cutting practice regulations ".

The Report summarizes the prospective costs and returns of these recommendations, and concludes that the recommended increase (of about $77 million annually above the present $100 million now being spent each year) would be met jointly by the States and by the Federal Government. As to return on investment: " within the next 25-50 years this increase should add 10-15 million board feet a year to the supply of harvestable saw timber. At 1950 prices this would add $120-170 million a year to stumpage values.

" Thus it appears that by spending $77 million a year more, and making capital investment of $ 360 million, the Nation could add at least $ 120 million and perhaps as much as $ 170 million to the annual timber harvest. Financially, the recommendations seem justified. At the same time they would assure continuing supplies of an indispensable raw material for industry ".

In Volume IV there is a brief discussion of improved technology in the handling of forest resources, particularly in mechanical harvesting and handling devices, physical and chemical wood processing and hydrolysis of residues. There are two chapters devoted to improved technology of forest products, and in the building industry.

The final volume consists of special reports, devoting two chapters to the field of forestry and one to domestic resources.

It discusses long range timber requirements and the adequacy of timber, and reviews existing programs of private forest practices, public forestry policies and the role of public forests. There is also a chapter on the free world's forest resources which leans heavily on FAO's Forestry Division publications to supply information on world trade in wood products and forest resources situation in Canada, Western Europe, Latin America, Central and South Africa, North Africa and Near East, Southeast Asia, Oceania and Japan.

This chapter concludes with an interesting discussion on the expanding industrial wood output which can be achieved through the application of better forest management and the opening up of the forest resources of less well developed countries and expanding operations in underdeveloped forest areas. This is to be achieved by aid to underdeveloped countries, by the programs of the U.S. Government supplementing the efforts of FAO and other international organizations in this field.

This comprehensive report is an important milestone in that it relates the forest resources of an important country like the United States to all other resources in one complete picture of the national economy and places this in proper perspective to the world community.

TIMBER DRYING. R.G. Bateson (3rd edition), pp. 137. Illus. Crosby Lockwood and Son, Ltd. London. 1952. 15s. Od.

This book provides useful information to those concerned with air-drying or kiln-drying of timber. It emphasizes the importance of drying to the behavior of timber in use and discusses the various defects which may develop during drying. For air-drying, the construction of stacks for various types of timber is discussed. Exception may be taken to the statement, without qualification, that " sleepers are almost entirely cut from free-drying softwoods which are tolerant of severe drying conditions ". This may be the case in the United Kingdom, but elsewhere hardwoods are used extensively for this purpose.

The design and construction of various types of kilns are discussed and well illustrated, and suitable kiln schedules for various timbers recommended. There is a noteworthy description of the construction and operation of a simple but efficient drying kiln, which was developed at the Forest Products Research Laboratory, Princes Risborough.

For the specialty woodworker, who has occasion to dry small lots of many timbers after they have been treated in a kiln, the conditions necessary for a warm store are given.

As regards the behaviour of seasoned timber in use, the movement of timber with changing atmospheric conditions and means for reducing or minimizing this movement are discussed; emphasis is given to the behavior of seasoned timber in new buildings.

In addition, various seasoning problems, such as collapse in hardwoods, splitting and checking are mentioned, as well as the importance of reconditioning in correcting the warping which results from collapse.

DIE PAPPELKULTUR (Poplar Cultivation). W. Wettstein. pp. 52. Illus. Austrian Society for Wood Research. Vienna. 1952. U.S. $ 1.00

This booklet describes the growing importance of poplar hybrids for Austrian industries, including plywood, matches, wooden shoes, boxes and, recently, pulp and paper, also the continuous supply of which can be easily secured through poplar growing on about 25,000 ha. of wet soils, a small fraction of the lands subject to yearly inundations in Austria. It is designed to inform the practical planter and to guard him from failure mostly due to errors in the selection of site, planting materials and cultivation methods. Thus, an account of site requirements and cultivation methods is followed by a survey of the salient features of the many different kinds and hybrids of poplars, including remarks on their possible utilization and timber properties.

Austria is among the 16 member countries of the International Poplar Commission and aims to further poplar cultivation through the Forest Administrations and Chambers of Agriculture and Forestry in its federal states.

(*Continued from inside front cover*)

temperate zone can be adapted fully to the more severe conditions of the tropics. Impregnation has to stand the leaching effect of the heavy rains and attacks by termites and many other insects; the hot sun during the dry season causes cracking and splitting which, however, can be avoided by use of inexpensive bandages, a method widely applied in Central Europe in recent years.

The use of timber for railway cars is also undergoing fundamental changes. Impregnation by new types of relatively inexpensive synthetic resin produces a great increase of durability, better retention of shape under severe climatic conditions and improved mechanical properties. Large-size building boards ensure better insulation and improved appearance.

Many of the Eastern countries have thousands of miles of navigable inland waterways and are planning to modernize and mechanize their means of inland navigation. The production of new boat building materials, to replace in part the traditional expensive species by improved timber products is being investigated.

Secondary hardwoods can be used for bridge construction and for telephone and minor transmission lines instead of steel if careful chemical treatment and proper engineering is applied.

PAPER is another essential contribution of forests to the economy of the region. In the world as a whole, pulp and paper consumption have been rising steadily many decades. Since the war, production of pulp for paper of all types has gone up by more than 7 million metric tons. But the increased consumption has been most uneven as between countries. At present, in countries of this region, average paper consumption per person is less than 1 kg. per year.

Among the pulp raw materials available in the region, the vast resources of bamboo rank first. Regarding fiber length (about 3 mm.), bamboo replaces in the East the conifers of the temperate zone and permits the production of high-grade writing and printing paper. Additional raw materials for chemical pulp are sabai grass, rice straw and bagasse. The production of mechanical pulp and newsprint, however, is still practically nil, although this commodity is badly required by most of the countries. A search for sufficient quantities of light broadleaved species, suitable for grinding, has to be initiated all over the region. FAO has started a worldwide pulp and paper survey, sending teams of experts to many countries to investigate the technical and economic possibilities for creating new centers of production. It is anticipated that the general situation can be assessed within a very short time and that, soon after this first phase, specific development programs for different regions can be worked out.

THE story of the contribution of forests to economic progress would be incomplete without mentioning the correlation of forests and food. The history of nearly every nation shows that in the early stages food is derived to a high degree from forest by grazing, hunting, fishing, collection of honey, fruits, mushrooms and manifold other products. This situation is still true for many areas of the East. Modern technique, however, has developed additional means to convert even wood into different types of fodder and food stuff.

Dreid wood yeast contains a high percentage of protein (45-50 percent) and it is a good source of vitamins of the B group. A daily ration of a few grams only could greatly enrich the main food suppuly which is mostly deficient in protein-vitamin content. Especially for feeding of children in famine areas it could be of great assistance.

The drawback up till now, however, has been the strong flavor and the cost. Il the development of a flavorless yeast materializes and further reduction of cost can be achieved, production of wood yeast may become practicable as provision against cases of emergency.

A Power Alcohol Seminar, recently held at Lucknow (India) with FAO cooperating, dealt among other things with the sacharification of wood. The results of this meeting may help to clarify the technique which, could one day become of great practical significance for the protein and vitamin supply of the famine areas of the world.

UNASYLVA is prepared by the Forestry Division and published quarterly in English, French and Spanish by the Documents Service at FAO's Headquarters in Rome. FAO does not hold itself responsible for statements or views expressed by authors of signed articles. UNASYLVA may be obtained from the sales agents listed on the back cover. Annual subscription, Us $ 2.50; 12s. 6d. Single copy, 65 cents; 3s. 3d. Rates are payable *in local currencies* when orders are placed through local sales agents. A full series of back numbers is still available.

1952 Yearbook of Forest Products Statistics

Sixth Yearbook of international forest products statistics to be published by FAO. It contains 1951 official information on production and trade and revised data for 1950, as reported by more than one hundred countries and territories in reply to a standard questionnaire.

The statistical tables are preceded by a short text which gives some salient features of the 1951 world situation. World and regional figures given here include estimates for non-reporting countries; in the statistical tables, the totals are for reporting countries only.

This Yearbook provides the most consistent and useful body of international forest products statistics now available. The tables cover the following topics:

- ROUNDWOOD
  - *Total Output*
  - *Sawlogs & Veneer Logs—Trade*
  - *Pulpwood—Trade*
  - *Pitprops—Output & Trade*
- WOOD PULP, NEWSPRINT, PAPER AND PAPERBOARD, AND FIBERBOARDS
  - *Production — Consumption — Trade*
- PROCESSED WOOD
  - *Lumber, Plywood, and Sleepers — Production — Consumption — Trade*
- WORLD TRADE — Summary
  - *Volume of Imports and Exports*
  - *Value of Imports and Exports*
- COMPARATIVE DATA
  - *Forest Products Balances*
  - *Per Caput Consumption of Forest Products*
  - *Forest Areas*

Published by the Food and Agriculture Organization of the United Nations. Bilingual: English-French with Spanish supplement. Paper bound. 8½ × 11 in. Rome, Italy. Price: U.S. $2.50; 12s. 6d.

SALES AGENTS FOR FAO PUBLICATIONS *

Argentina: Editorial Sudamericana, S. A., Alsina 500, Buenos Aires; **Australia**: H. A. Goddard Pty. Ltd., 225ª George Street, Sydney; **Austria**: Wilhelm Frick Verlag, Graben 27, Vienna 1; **Belgium**: Agence et Messaggeries de la Presse, 14-22 rue du Persil, Brussels; **Brazil**: Livraria Agir, Rua Mexico 98-B, Rio de Janeiro; **Canada**: The Ryerson Press, 299 Queen Street West, Toronto 2, Ontario; **Colombia**: "Agricultura Tropical", Avenida Jiménez No. 8-74, Bogotá; **Costa Rica**: Trejos Hermanos, Apartado 1313, San José; **Cuba** René de Smedt, La Casa Belga, O'Reilly 455, Havana; **Denmark**: Ejnar Munksgaard, Norregade 6, Copenhagen K.; **Ecuador**: "La Hacienda", Malecón 710-711 y Roca, Guayaquil; **Egypt**: Librairie de la Renaissance d'Egypte, 9 Sh. Adly Pasha, Cairo; **El Salvador**: Manuel Navas y Cía., Iª Avenida Sur 35, San Salvador; **Finland**: Akateeminen Kirjakauppa, 2 Keskuskatu, Helsinki; **France**: Les Editions A. Pedone, 13 rue Soufflot, Paris 5ᵉ; **Germany**: Paul Parey, Lindenstrasse 44-47, Berlin SW68; **Greece**: "Eleftheroudakis" Constitution Square, Athens; **Guatemala**: Goubaud y Cía. Ltda., 5ª Avenida Sur No. 28, Guatemala; **Haiti**: Max Bouchereau, Librairie "A la Caravelle", P. O. Box 111B, Port-au-Prince; **Iceland**: Halldor Jonsson, Mjostraeti 2, Reykjavik; Jonsson & Juliusson, Garöastraeti 2, Reykjavik; **India**: The Oxford Book and Stationery Co., Scindia House, New Delhi; 17 Park Street, Calcutta; The Mall, Simla; Messrs. Higginbothams, Mount Road, P. O. Box 311, Madras; Kitab Mahal, Publishers, 235-237 Hornby Road, Bombay; **Ireland**: The Controller, Stationery Office, Dublin; **Israel**: Blumstein's Bookstore Ltd., P. O. Box 4154, Tel Aviv; **Italy**: Libreria Internazionale Ulrico Hoepli, Galleria, Piazza Colonna, Roma; Libreria Internazionale Dr. Romano Romani, Via Meravigli 16, Milano; **Japan**: Maruzen Company Ltd., Tori-Nichome 6, Nihonbashi, Tokyo; **Lebanon**: Librairie Universelle, Avenue des Français, Beirut; **Mexico**: Manuel Gómez Pezuela e Hijo, Donceles 12, Mexico, D. F.; **Netherlands**: N. V. Martinus Nijhoff, Lange Voorhout 9, The Hague; **New Zealand**: Whitcombe & Tombs Ltd., Auckland, Wellington, Hamilton, Christchurch, Dunedin, Invercargill, Timaru; **Norway**: Johan Grundt Tanum Forlag, Kr. Augustagt. 7ª, Oslo; **Pakistan**: *East*: Farcos' Publications, P. O. Box 13, Ramna, Dacca. *West*: Ferozsons, 60 The Mall, Lahore; Variawa Bldg., McLeod Rd., Karachi; 35 The Mall, Peshawar; **Peru**: Libraría Internacional del Perú S. A., Casilla 1417, Lima; **Philippines**: D. P. Pérez Company, 169 Riverside, San Juan, Rizal; **Portugal**: Livraria Bertrand, S.A.R.L., 73-75 Rua Garrett, Lisbon; **Sweden**: C. E. Fritze, Fredsgatan 2, Stockholm 16; Gumperts AB, Göteborg; Hendrik Lindstahls, Bokhandel, Odengatan 22, Stockholm; **Switzerland**: Librairie Payot, S.A., Lausanne and Geneva; Hans Raunhardt, Kirchgasse 17, Zurich 1; **Syria**: Librairie Universelle, Avenue Fouad 1ᵉʳ, P. O. Box 336, Damascus; **Thailand**: Requests for FAO publications should be addressed to: FAO Regional Office for Asia and the Far East, Maliwan Mansion, Bangkok; **Turkey**: Librairie Hachette, 469 Istiklal Caddesi, Beyoglu, Istanbul; **Union of South Africa**: Van Schaik's Bookstore, Box 724, Pretoria; **United Kingdom**: H. M. Stationery Office, P. O. Box 569, London S.E.I.; **United States of America**: Columbia University Press, International Documents Service, 2960 Broadway, New York 27, N. Y.; **Uruguay**: Héctor d'Elia, Oficina de Representación de Editoriales, 18 de Julio 1333, Montevideo; **Venezuela**: Suma S. A., Sabana Grande 102, "El Recreo", Caracas; **Yugoslavia**: Drzavno Preduzece, Jugoslovenska Knjiga, Belgrade.

Requests from countries where sales agents have not yet been appointed may be sent to: FAO Documents Sales Service, Food and Agriculture Organization of the United Nations, Viale delle Terme di Caracalla, Rome, Italy.

** FAO publications are priced in U.S.$ and pounds sterling. Payment to FAO sales agents may be made in local currencies.*